The Roller Bandage

Hopkins

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THE

ROLLER BANDAGE

WITH A CHAPTER ON

SURGICAL DRESSING

BY

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WITH ILLUSTRATIONS

FOURTH EDITION

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PREFACE.

THE plan which has been adopted in this book, as will be seen at a glance, is to teach by numerous illustrations rather than by elaborate description the method of applying the roller bandage. In order that the student may most readily familiarize himself with this very important subject, a series of illustrations is presented which were made in the following manner: Each bandage was applied to a living model, and whenever the roller pursued a course which the author has found in his association with students was the cause of any uncertainty, it was at once photographed. From these photographs accurate drawings were made. In this way it is hoped that the intricate course traversed by the roller in the most complex dressing has been made sufficiently plain to enable the student to apply it for himself almost unaided by the text. The latter will be found very

brief and devoid of everything but the rule for application and the use to which the dressing is commonly put.

A series of definitions and general rules for bandaging occupy the earlier pages of the book.

The chapter on the dressing of wounds, which has been added to this the fourth edition of the book, is not intended to include within its scope the more general subject of the treatment of wounds, but rather to condense into a small space the general principles of surgical dressing considered from a purely practical stand-point, and to confine the description of methods of wound-dressing to a few which are simple and reliable.

W. B. H.

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THE ROLLER BANDAGE.

Definition.—The term roller bandage is generally used to indicate a strip of muslin rolled into a cylindrical form like tape. When other material than muslin is employed, as India-rubber, gauze, flannel, crinoline, or silk, it is usually designated as a rubber bandage, a gauze bandage, or a crinoline bandage.

Materials.—Unbleached muslin of medium quality is best adapted for the purposes of the ordinary roller. This is torn into strips of the proper length and breadth, removing the selvedge and leaving the ravel as much undisturbed as possible. Gauze for aseptic bandages and crinoline for plaster of Paris are *cut* into strips of the required dimensions, as these materials cannot be torn evenly. India-rubber rollers are usually procured ready made, though pure rubber sheeting of different weights is available for special bandages.

Rolling.—The strip of muslin having been torn, may be rolled either by hand, by a key, or by a machine. In rolling by hand, one extremity of the bandage is folded upon itself three or four times, when it is handled as a cigarette is rolled until the core becomes sufficiently firm to resist pressure on end. It is then held between the thumb and index finger of the left hand, and is made to revolve upon its long axis by the thumb and fingers of the right hand, as shown in Fig. 1.

FIG. 1.

A bandage may be more quickly and firmly rolled by using a key, shown in Fig. 2. This is made of brass, has an ordinary key-handle, a tapering octagonal shaft, and a smooth tip. The

dimensions of the shaft are,—four inches in length, one-quarter of an inch in diameter at the shoulder, and one-fifth at the tip. After fixing one extremity of the bandage on the key, the latter is made to revolve by the right hand, while the left holds the tip of the instrument in its palm, and guides the course of the bandage between

Fig. 2.

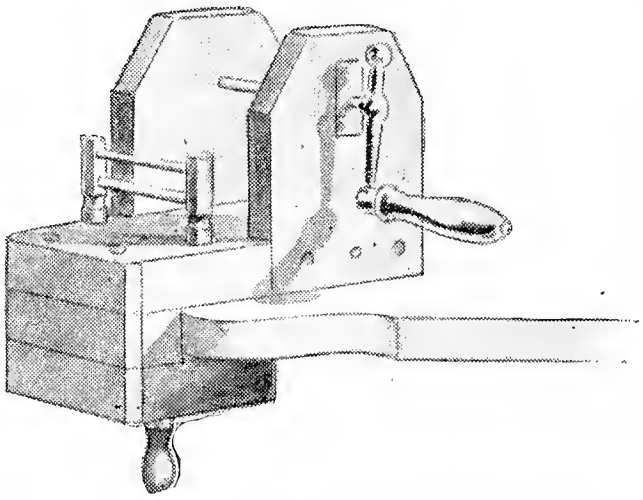
Author's key for rolling bandages.

Fig. 3.

the thumb and fingers. When the roller has reached a certain size, it may be held in the manner shown in Fig. 3. Any tendency of the roller to run off its proper course may be overcome by pressure with the little finger of the left hand, if it deviates towards the handle of the key, and by pressure with the index finger if towards the tip.

The bandage machine consists of a reel, with a crank and octagonal shaft, mounted upon a base which is made to screw to a table. Set in the base are two uprights, which support wooden rods. Through these the bandage travels in its course from the left hand to the reel, their object being to regulate the direction and tension of

FIG. 4.



the roller. After the bandage is rolled, it may readily be withdrawn from the machine by reversing the direction of the crank and pulling out the shaft, as the latter is quite movable. This apparatus is shown in Fig. 4.

Size.—Although bandages vary in length from two to ten yards, and in width from three-quarters of an inch to four inches, there are two

sizes in common use with which almost any dressing may be applied. They are the roller (two and a half inches by seven yards) and the finger roller (three quarters of an inch by three yards). For children under ten years of age, the length and breadth of a bandage suitable for an adult may each be divided by two.

Uses.—The roller bandage is used for so great a variety of purposes that it would be quite beyond the scope of these definitions to attempt to enumerate them, except in the most general way. To retain almost all dressings and splints. To prevent or control œdema, oozing of blood or serum, spasm of muscles after fracture, or as itself a fracture dressing; in fact, almost everywhere that surgical interference is required.

Tension.—Too much care cannot be exercised in applying a bandage in each individual case, to estimate how much tension should be used, in order to fulfil the object for which it is employed, advantageously and prudently.

A bandage may be applied *tightly*, *moderately*, or *loosely*. These grades may be readily tried upon one's own person. A tight bandage makes a healthy hand throb. A bandage moderately

applied gives the support of a comfortable glove, and a loose bandage is one which may retain a compress resting upon the eye without discomfort. The conditions governing the tension of the roller will be formulated as (*a*) those depending upon the roller itself, and (*b*) those which exist in the part bandaged:

a. 1. *The Circumference of the Part bandaged.*—The greater the circumference, the more force must be used. Thus, in applying a roller to the lower extremity, it is necessary, in order to secure an equal support for the entire limb, that each turn covering a greater circumference should be drawn a little more firmly than the preceding turn. The thigh turns requiring considerably more force to produce a given tension than those at the ankle.

2. *Whether the Bandage includes the entire or only half the Circumference of the Limb, as in the Application of Splints.*—When these are applied, much of the force used is expended upon them, the limb receiving less pressure than if the roller surrounded it alone.

3. *Incomplete Bandaging.*—Any bandage which leaves a considerable portion of the distal ex-

tremity of a limb uncovered is very liable to induce swelling. If the hand or the foot is left uncovered, while the rest of the limb is bandaged, swelling is very likely to occur. Once started, it progresses very rapidly, because it increases the tension of the lower border of the bandage. This of course promotes the swelling, and so these active and passive agents react upon each other to the complete strangulation of the limb.

4. *The Character of the Dressing beneath.*—Where a mass of soft yielding material like cotton or gauze is interposed, much more force is necessary to give the requisite tension than where a thin dressing or none at all is used.

5. *Increase of Tension from Flexion or Extension.*—If a spica bandage is applied to the shoulder with the arm elevated, its tension will be much increased by bringing the arm to the side of the body. In the same manner the tension of a spica of the groin, applied with the thigh flexed upon the abdomen, will be increased when the latter is extended.

6. *The Number of Turns.*—Each additional turn applied to the same part of a limb increases the tension nearly double. When, therefore, a roller

starts at the wrist, passes to the hand, and returns to the wrist, the latter receives too much tension, unless the first wrist turns are made very loosely. The same is true to a less extent when successive turns are made very close together.

7. *Shrinkage.*—Due allowance should always be made for shrinking of the muslin, if it is known or suspected that from any cause it will become wet.

b. 1. *Texture and Condition of the Tissues.*—Hard infiltrated tissue, such as is frequently found accompanying ulcers of the leg, requires very firm pressure, while very moderate pressure only can be employed in bandaging the flabby, unresisting limbs of delicate children and aged persons. An acute inflammatory condition of a part will not admit of pressure, while very considerable tension is well borne by a doughy, œdematous condition of the tissues.

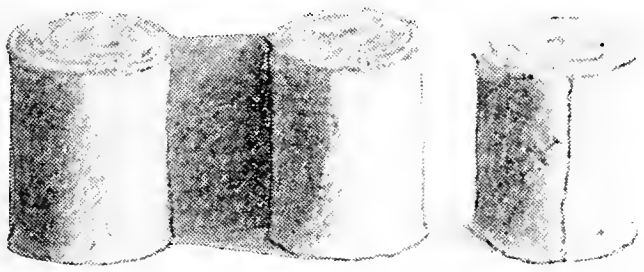
2. *Habit.*—Independent of advance or subsidence of swelling, a bandage may be applied more firmly when the patient has become accustomed to its presence.

3. *Situation.*—Care must be observed, when

bandages about the chest are applied, that respiration shall not be interfered with, particularly if the dressing is completed before the patient has quite recovered from the effects of an anæsthetic.

4. *Change in Position.*—Marked swelling always occurs when a limb which has been kept horizontal for many weeks is suddenly allowed to hang. In this way a fixed dressing of silicate of

FIG. 5.



sodium or plaster of Paris, comfortable while the patient is on his back, frequently has to be cut when he gets up.

Varieties.—The single roller, which is almost invariably used, and the double roller. They are shown in Fig. 5.

Parts of the Roller.—The single roller is composed of seven parts,—the initial and terminal extremities, the upper and lower borders, the

external and internal surfaces, and the body. The initial extremity is the free, and the terminal extremity is in the centre of the cylinder. The borders are designated according to the position they occupy when the subject stands erect. The surfaces are denoted by their relation to the centre of the cylinder, and the body includes all. The double roller has eight parts,—two terminal extremities, two borders, two surfaces, two bodies, and no initial extremity.

APPLICATION.

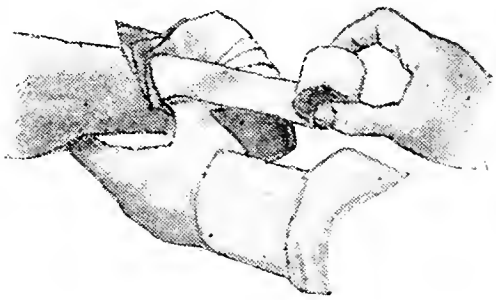
To Fix.—A roller is fixed by placing the external surface of the initial extremity upon the point at which it is to start with the thumb and index finger of the left hand. With the body of the roller held in the right hand two turns are made in the direction taken by the hands of a clock. The first turn must be made by the right hand alone, after which the left hand, being free, may alternate with it.

To Repeat.—To repeat is to make a second turn completely hide a preceding turn. This is always done in a circular bandage, and in fixing the initial extremity.

To Overlap.—To overlap is to make a second turn cover one-half, two-thirds, or three-quarters of a preceding turn. This is done in all spirals.

To Recur.—To recur is to catch a turn at some point and reflect it upon itself, so that it either

FIG. 6.



exactly retraces its course or slightly diverges in another direction (Fig. 6). This is done in re-

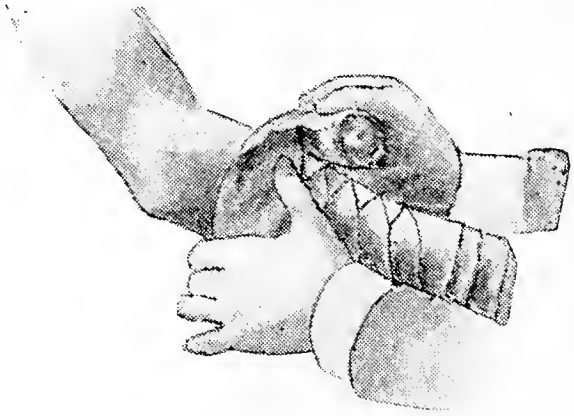
FIG. 7.

currents of the stump (Fig. 7) and the recurrent of the scalp.

To Reverse.—To reverse is to bring the internal surface of the roller next the skin instead of the

external. The right hand being in a state of supination when it receives the body of the roller from the left, makes a reverse by simply being pronated (Fig. 8). While the right hand

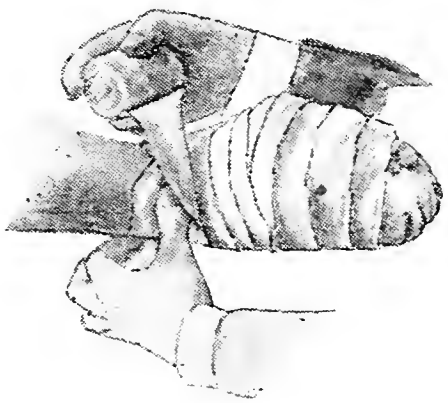
FIG. 8.



effects this movement, the thumb or index finger of the left is placed upon the last turn, which has been applied in order to retain it in position, as the free portion of the roller should hang perfectly slack when the reverse is being made. After making the reverse, the roller is passed around the limb and delivered to the left hand, and not until then is the traction necessary to produce the required tension employed. The succeeding reverses are made in the same way, and they will be even and symmetrical if the

thumb or index finger of the left hand is placed in the same perpendicular line it before occupied while retaining the preceding turn, and if each turn is made to overlap the preceding one to the same extent in its entire circumference. The object of the reverse is to make the roller adapt itself to a conical cylinder, whose diameter is increasing, as from the ankle to the calf.

FIG. 9.

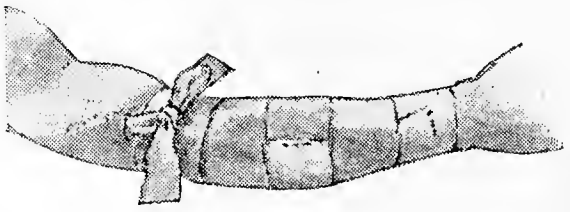


To Reverse Descending.—To make a descending reverse, the right hand is placed in a state of pronation when about to receive the body of the roller from the left, and is simply turned to supination, while the left thumb retains the turn already made as in the ordinary reverse (Fig. 9). The descending reverse becomes necessary when the roller is applied to a part the diameter of

which is constantly diminishing, as in the leg from the calf to the knee when the former is very large, and when thickly padded splints are applied to the hand, etc.

To Secure.—To secure the terminal extremity of the roller, either a pin is used, which includes one or more of the previous turns, or the end is slit into two tails, which are carried around the part in opposite directions and tied. The pin may be introduced parallel or at right angles with the long axis of the roller. These methods of securing are shown in Fig. 10. The pin

FIG. 10.



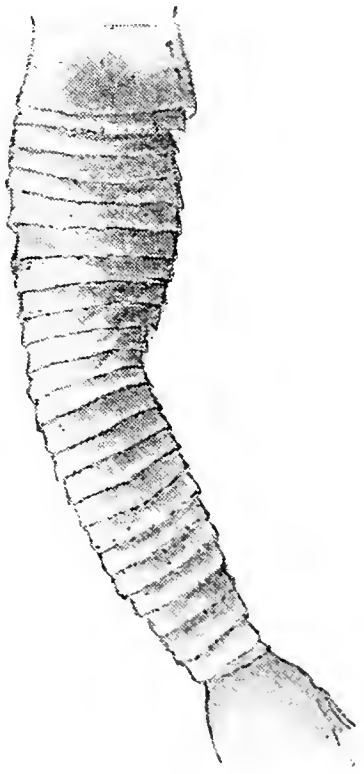
should always be directed downwards; it should appear to view at least twice in its course through the underlying layers of muslin, and its point should be carefully buried. These precautions are necessary to prevent the pin doing harm, as the hand is usually carried down the limb to ascertain if the roller has been properly applied.

To Remove.—When removing the roller, each turn should be gathered compactly in the hand, no loops or ends being allowed to trail.

SPECIAL BANDAGES.

A Circular Bandage.—A circular bandage consists of a series of three turns which repeat each other.

Fig. 11.



A Spiral Bandage.—A spiral bandage is one each turn of which, after the initial extremity is fixed, overlaps one-half, two-thirds, or three-quarters of the preceding turn. Such a bandage applied to a part having various diameters will not adapt itself (Fig. 11).

An Oblique Bandage.—An oblique bandage resembles a spiral, except that the limb is ascended so rapidly that the borders of the turns do not touch. It is only used to retain a temporary or loose dressing (Fig. 12).

A Spica Bandage.—A spica bandage is composed of two sets of turns alternating with one another, and coming in contact only at the point where it is intended to make pressure or retain a dressing.

FIG. 12.

A Figure-of-Eight Bandage.—A figure-of-eight bandage frequently resembles a spica very closely. It also is composed of two sets of turns made in different directions, but the direction of these turns gradually converges.

A Spiral Reversed Bandage.—A spiral reversed bandage consists of a series of spiral turns, most of which have been reversed.

A Recurrent Bandage. (See *To Recur*, page 19.)

BANDAGES OF THE HEAD.

ALL bandages applied to the head, except Barton's, are fixed either by circular turns running horizontally about the vault of the cranium, or

FIG. 13.

by circular turns vertically around the face. After the former method are fixed the crossed of the angle of the jaw, recurrent of scalp,

figure-of-eights of the eye, Hunter's, White's, and the knotted bandage (Fig. 13), while Gibson's

FIG. 14.

and the occipito-facial are fixed by the latter (Fig. 14).

BARTON'S BANDAGE.

2 inches by 5 yards.

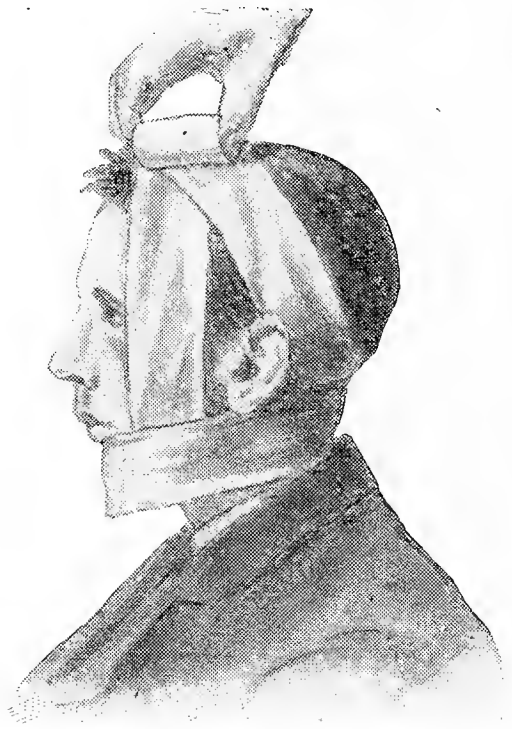
Place the initial extremity of the roller behind the ear on the sound side. Carry the roller

FIG. 15.

beneath the occiput to a corresponding point behind the ear on the injured side. Thence to the vertex, and down the sound side of the face to the chin. Up on the injured side to the ver-

tex, intersecting the former turn directly in the median line, and back to the starting-point. Not until then is the bandage fixed. The fingers holding the initial extremity are now released,

Fig. 16.



and the roller may be conveniently passed from one hand to the other (Fig. 15). The roller passes from here to the occiput, and along the injured side of the jaw to the chin, and back to the occiput. From the occiput to the vertex (Fig. 16). Each of these turns is repeated in

a similar manner twice, when the bandage is terminated at the vertex. Every intersection requires a pin (Fig. 17).

FIG. 17.

Uses.—Fracture of the body of the lower jaw, after luxation, and to retain dressings at various points along the course traversed by the bandage.

It is also a useful substitute for the leather head-gear of Sayre's suspension apparatus for applying the plaster jacket, when the latter is not available.

GIBSON'S BANDAGE.

2 inches by 5 yards.

Fix the roller by vertical turns around the face. The direction it takes in starting is determined by the location of the fracture, the roller always ascending on the injured side. After making three of these vertical turns, a right-angled reverse is made at the temple, on whichever side is most convenient, and the bandage carried back to the occiput (Fig. 14). Three horizontal turns are then made around the vault of the cranium, and on reaching the occiput the third time the chin turns are begun. These are made by carrying the roller beneath the ear, along the side of the jaw to the front of the chin, and back to the occiput. Three of these turns are made. On reaching the occiput the third time, the bandage is completed by a right-angled reverse at this point, whence it is carried over the top of the head to the forehead in the median line (Fig. 18). A pin is introduced at the reverse over the occiput, and at each inter-

section. It will be seen to consist of three sets of circular turns.

FIG. 18.

Uses.—Fracture of the body of the lower jaw, after luxation, and to retain dressings.

OCCIPITO-FACIAL BANDAGE.

2 inches by 2 yards.

Fix the roller by vertical turns around the face. After making three of these turns, re-

verse over the temple on the most convenient side, and carry the roller to the occiput, and back to the opposite temple. It may be pinned here (Fig. 19), or continued around the forehead to the point at which the reverse was made. The re-

FIG. 19.

verse must also be pinned. The bandage is simply the first and part of the second circulars of Gibson's.

Uses.—To restrict the movement of the jaw after luxation, and to retain dressings.

CROSSED BANDAGE OF THE JAW.

2 inches by 5 yards.

Fix the roller about the vault of the cranium, delivering it from the left to the right hand, if the jaw is fractured on the left side, and from the right to the left, if the fracture is on the right side. On reaching the occiput the third time, carry the roller beneath the ear, under the chin to the angle of the mouth on the opposite side. Ascend to the vertex. Descend behind the ear on the sound side to the throat, and up again on the injured side to the vertex. Each ascending turn overlaps the preceding turn three-quarters. Each descending turn passes behind the ear on the sound side, and exactly repeats the preceding turn. So continue until the angle of the jaw on the injured side is covered. This is usually accomplished in about four turns, when the bandage may be pinned (Fig. 20), or a right-angled reverse made over the temple, and a circular turn, repeating those applied at the beginning, carried around the head.

Fig. 20.

Use.—Fracture of the lower jaw with troublesome lateral displacement.

RECURRENT BANDAGE.

2 inches by 7 yards.

Fix the roller about the vault of the cranium. On reaching the occiput the third time, make a right-angled reverse, and carry the roller in the median line over the top of the head to the

brow, at which point the finger of an assistant must hold the bandage. Recur to the occiput, overlapping three-quarters of the first turn on one side. Recur to the forehead, overlapping three-quarters on the other side of the first turn. So continue until the entire scalp is covered, when two circular turns are made to fix the recurrents. Pin deeply into the layers in front and at the back (Fig. 21).

FIG. 21

Uses.—To retain dressings to the scalp, and to make compression.

FIGURE-OF-EIGHT BANDAGE OF ONE EYE.

2 inches by 5 yards.

Fix the roller about the vault of the cranium, bandaging from left to right, if the right eye is to be covered, and from right to left, if the left eye. On reaching the occiput the third time,

FIG. 22.

pass the bandage below the ear, across the eye, and to the tuberosity of the parietal bone on the opposite side. Thence to the occiput. Repeat this turn twice, and again follow the fixing turns around the head. Pin both intersections (Fig. 22).

Uses.—To retain dressings, and make compression upon the orbit.

FIGURE-OF-EIGHT BANDAGE OF BOTH EYES.

2 inches by 7 yards.

Fix the roller around the head. Cover one eye as in the preceding bandage, and, after mak-

FIG. 23.

ing one circular about the head, proceed on reaching the forehead to cover the other eye in a similar manner (Fig. 23).

Uses.—To retain dressings, or compress both eyes.

HUNTER'S V BANDAGE.

2 inches by 3 yards.

Fix the roller about the vault of the cranium. On reaching the occiput the third time, carry the bandage beneath the ear, along the jaw to the

FIG. 24.

front of the chin, and back to the occiput. Then alternate between head and chin turns, making two or three of each. This bandage follows the same course as the second and third circulars of Gibson's (Fig. 24).

Uses.—To fix dressings, and retain parts in apposition about the chin and lips.

WHITE'S HEAD AND NECK BANDAGE.

2 inches by 3 yards.

Fix the roller about the vault of the cranium, and on reaching the occiput the third time, pass

FIG. 25.

directly down in front of the throat. Alternate two or three head and neck turns, and pin the bandage at the most convenient point (Fig. 25).

Uses.—To apply dressings, or approximate wounds in front of the neck.

KNOTTED BANDAGE.

2 inches by 7 yards.

For this a double-headed roller is employed. Place the free portion between the bodies upon the temple on the injured side, and carry the heads around the vault of the cranium to a corresponding point on the opposite side. Here the heads of the roller pass each other, and continue their course back to the starting-point. When this point is reached, they make a half turn upon each other, and pursue a vertical course around the face, passing as before on the sound side. Reaching the injured side again, another hitch is made, and the roller carried horizontally around the head. So alternate face and head turns until three or four knots have been made, when the terminal extremities may

be tied together or pinned at the most convenient point (Fig. 26).

FIG. 26.

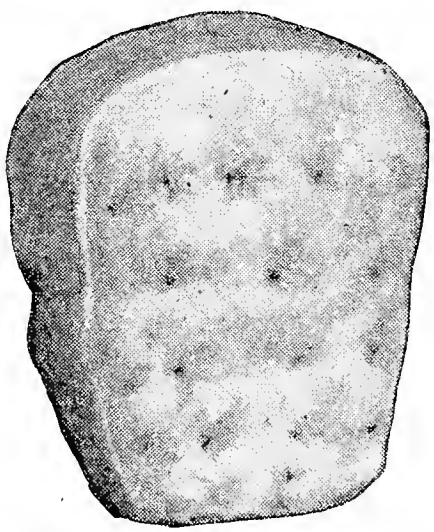
Use.—To control hemorrhage from the temporal artery.

BANDAGES OF THE UPPER EXTREMITY.

DESAULT'S BANDAGE.

This bandage is compound in character, requiring for its application three rollers and a wedge-shaped pad. The pad is made of strong

Fig. 27.



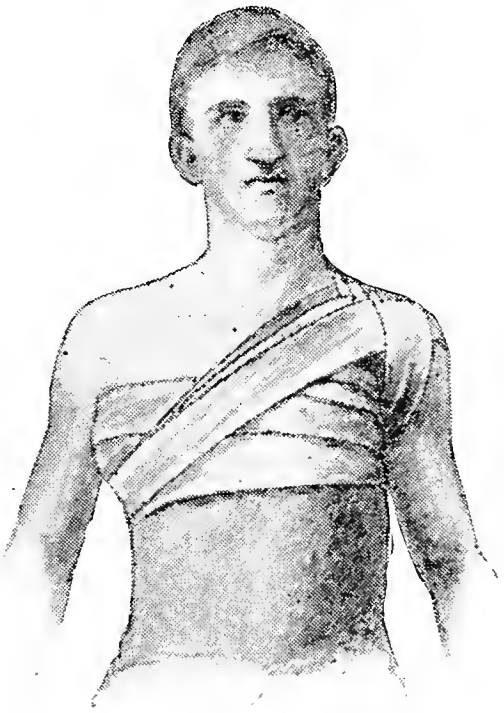
muslin stuffed with hair or bran, is about five inches square, two inches thick at the base, and bevels off to nothing at the apex (Fig. 27).

FIRST ROLLER OF DESAULT.

2½ inches by 5 yards.

Place the initial extremity of the roller on the pad, the base of which is thrust into the axilla on the injured side, and make four spiral turns,

FIG. 28.



encircling the thorax and pad. On reaching the pad the fourth time, carry the roller well down under its apex, and thence across the front of the chest to the shoulder on the sound side.

Here a figure-of-eight turn around the arm is made, and the roller conveyed across the back to the apex of the pad again. Two more of these turns are made, either repeating each other, or, as shown in Fig. 28, overlapping to form a spica on the shoulder. The terminal extremity is then pinned at the most convenient point in front.

Use.—The spiral turns are to fix the pad, and the figure-of-eight turns to force it up into the axilla. A towel folded into a pad, and kept in place by a strip of adhesive plaster, is a more convenient plan for obtaining the indications of the first roller.

SECOND ROLLER OF DESAULT.

2½ inches by 7 yards.

Fix the initial extremity of the roller by two circular turns, which include the thorax and the arm on the injured side. They pass over the head of the humerus and under the sound axilla. Descend the chest and arm by spirals, overlapping one-half. These turns must constantly

increase in tension until the elbow is reached, when the bandage is pinned. The spirals may somewhat converge on the sound side, so that they overlap three-quarters (Fig. 29).

FIG. 29.

Use.—To force the head of the humerus outwards. This is done by the action of the lower spiral turns. These being applied with more tension than the upper ones convert the shaft of the bone into a lever, the fulcrum of which corresponds to the pad.

THIRD ROLLER OF DESAULT.

2½ inches by 7 yards.

Place the initial extremity of the roller under the axilla on the sound side, and carry it obliquely across the front of the chest to the middle of the summit of the shoulder on the injured

FIG. 30.

side. Down behind the humerus, and parallel with it, to the elbow; under the latter, and across the front of the chest to the axilla on the sound side, where the initial extremity is met and fixed (Fig. 30). The roller now passes under the axilla,

obliquely across the back to the middle of the summit of the shoulder on the injured side. Down in front of the humerus, and parallel with it to the elbow; under the elbow, and across the back to the axilla on the sound side, which com-

FIG. 31.

pletes one entire turn,—an anterior and a posterior triangle (Fig. 31). From this point it emerges, and is in position to cross the front of the chest to the shoulder on the injured side as before, and descend behind the humerus, and pass under the elbow, back again to the axilla.

Another posterior turn is then made. In this way three anterior and three posterior triangles are formed, which exactly repeat each other, and the end of the roller is pinned at any point in front. Each intersection also must be secured by pins or adhesive plaster, and a sling to sup-

FIG. 32.

port the forearm and hand completes the dressing (Fig. 32).

Use.—To draw the shoulder upwards and backwards. To accomplish this, it is evident that the posterior turns must be applied with more tension than the anterior.

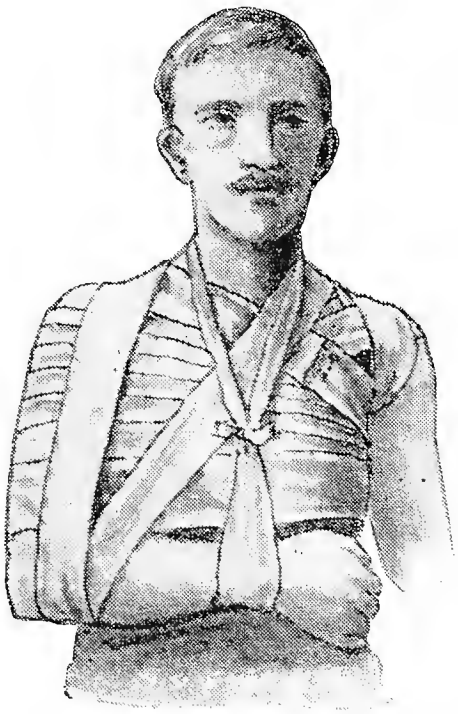
The bandage of Desault as a whole is employed usually for fracture of the clavicle. Portions of the dressing are, however, frequently used for other purposes; the second roller being applied when it becomes necessary to retain the arm to the side of the body for any cause, as in fracture of the humerus. The third roller may be used after dislocation of the head of the humerus or of the acromial end of the clavicle.

THIRD ROLLER OF DESAULT MODIFIED BY AUTHOR.

In order to obtain a more direct elevating force, the third roller may be applied as shown in Fig. 33. To do this, place the initial extremity under the sound axilla, carry the roller obliquely across the front of the chest to the shoulder on the injured side, down behind the arm and parallel to it, and under the elbow, as in Desault. From the elbow the roller ascends obliquely across the forearm and front of the chest *to the summit of the shoulder on the sound side, and down*

obliquely across the back to the elbow on the injured side. Thence it ascends the arm to the shoulder on the injured side, and returns across the back to the axilla on the sound side. Here it fixes

FIG. 33.



the initial extremity, and two more similar turns are made, which exactly repeat each other, when the terminal end is secured as in the original bandage. The anterior turns applied in this way lose to a great extent their power to draw the shoulder forward. The necessary precaution, to use more tension for the posterior than the an-

terior turns, when the roller is applied in the ordinary way, is therefore not required, as the direction of the forces and their relative points of application are of themselves sufficient to effect this result, besides gaining a greater elevating force.

VELPEAU'S BANDAGE.

2½ inches by 14 yards (two seven-yard rollers).

Place the initial extremity over the spine of the scapula on the sound side. Having placed the hand on the injured side upon the sound shoulder, carry the roller across the back to the injured side, pursuing the following course: the middle of the summit of the shoulder; the middle of the outer aspect of the arm, behind the elbow, across to the axilla on the sound side, and under it to the starting-point. Repeat this turn to fix the bandage (Fig. 34). On reaching the scapula the second time, make a circular turn around the thorax, including in it the arm on the injured side. The external condyle of the humerus being the point over which the middle

FIG. 34.

FIG. 35.

of the roller passes (Fig. 35), on its way back to the starting-point. A shoulder turn is now made, which overlaps the fixing turn three-quarters towards the median line of the body. Then another circular (spiral) turn overlapping the

FIG. 36.

preceding turn one-half. So, shoulder turns and spiral turns alternate until the former support the point of the elbow. After this spiral turns alone are continued, until the entire injured extremity up to the wrist is thoroughly supported. No sling is used in this dressing. Pins or ad-

hesive plaster must be generously used at critical parts (Fig. 36).

Uses.—Fracture of the clavicle, and after dislocation of the humerus.

FIGURE-OF-EIGHT BANDAGE OF THE NECK AND AXILLA.

2 inches by 4 yards.

Fix the initial extremity by circular turns

FIG. 37.

around the neck. Descend from the neck to the

axilla, carrying the roller from before backwards, if the right axilla is to be included, and from behind forwards, if the left. Pass under the axilla, ascend to the neck, and encircle it. So alternate until three turns have been made, either repeating one another, or, as shown in Fig. 37, overlapping three-quarters. This bandage cannot be applied so as to adapt itself neatly to the parts. It may be pinned at any point, preferably at the intersections.

Uses.—To retain dressings in the axilla, and to approximate wounds in the side of the neck.

SPICA BANDAGES OF THE SHOULDER.

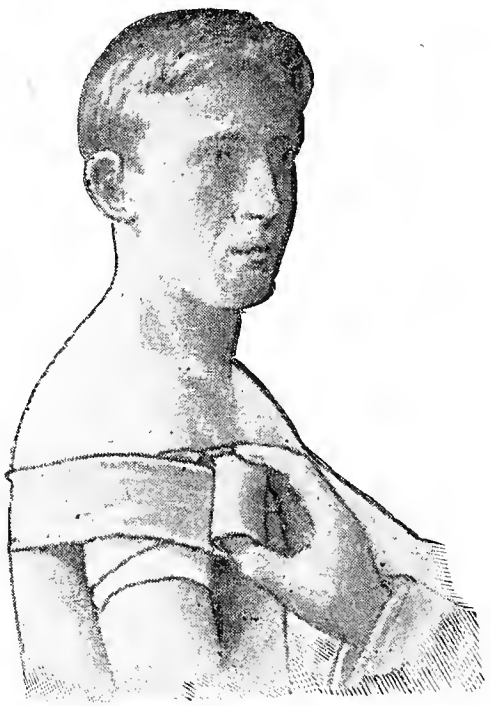
ASCENDING SPICA.

2½ inches by 7 yards.

Fix the initial extremity just above the middle of the arm on the injured side. Carry the roller across the front of the chest (if the right is the injured side, across the back if the left) to the opposite axilla; passing under this, return by the

back (or by the chest if the left side is being bandaged) to the injured side. In the ascending spica the lower border of the roller determines the position of the spica. This turn, therefore, should cross the previous turn, so that the lower

FIG. 38.



borders of both intersect at the outer side of the arm (Fig. 38). Encircle the arm and overlap, ascending two-thirds. Pass to the opposite axilla, gradually converging with the preceding turn so that at this point it will repeat it. So alternate between body and arm turns until the

shoulder is covered, when the bandage may be secured by a pin at the spica (Fig. 39).

FIG. 39.

Uses.—To retain dressings to the shoulder, to complete fracture dressings for the humerus, and after dislocation of the acromial end of the clavicle.

DESCENDING SPICA.

2½ inches by 7 yards.

Fix the initial extremity to the upper part of the arm. Carry the roller to the base of the

FIG. 40

neck, and pass across the front of the chest (or the back, if the left side is being bandaged) to the opposite axilla. Return across the back (or front of the chest, if the left side) to the base of the neck on the injured side. In the de-

scending spica, the upper border of the bandage determines the position of the spica. The upper borders of this turn and the preceding one should, therefore, coincide at the junction of the base of the neck and summit of the shoulder (Fig. 40).

FIG. 41.

Pass under the axilla on the injured side, and so continue overlapping two-thirds at the spica, descending and converging under the axilla on the sound side, until the shoulder is covered (Fig. 41). Pin the terminal extremity at the spica, or at any point in front.

Uses.—To retain dressings higher up on the

shoulder than can be neatly done by the ascending spica.

SPIRAL REVERSED BANDAGE OF THE UPPER EXTREMITY.

2½ inches by 7 yards.

Fix the initial extremity at the wrist, carrying the roller from left to right in bandaging either

FIG. 42.

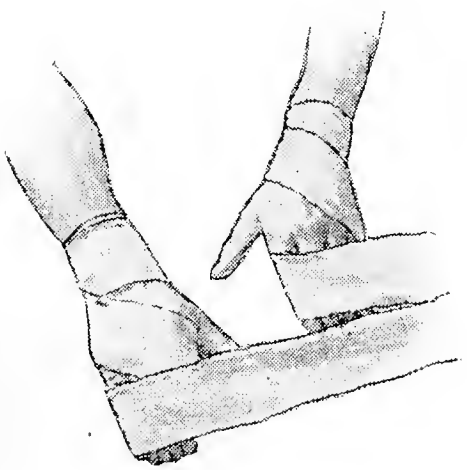


FIG. 43.

side. Pass across the back of the hand (from the ulnar to the radial side, if the right hand, and from the radial to the ulnar, if the left) to the tips of the fingers (Fig. 42). Here make a

circular and a spiral reversed turn. Two figure-of-eight turns above and below the thumb are then made (Fig. 43), and the roller is carried up to the wrist. Continue up the forearm with spiral turns until the diameter of the latter increases sufficiently to render reverses necessary (Fig. 44). Make these until a point near the elbow is

FIG. 44.

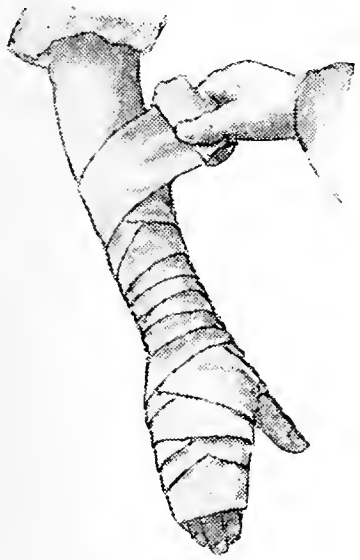
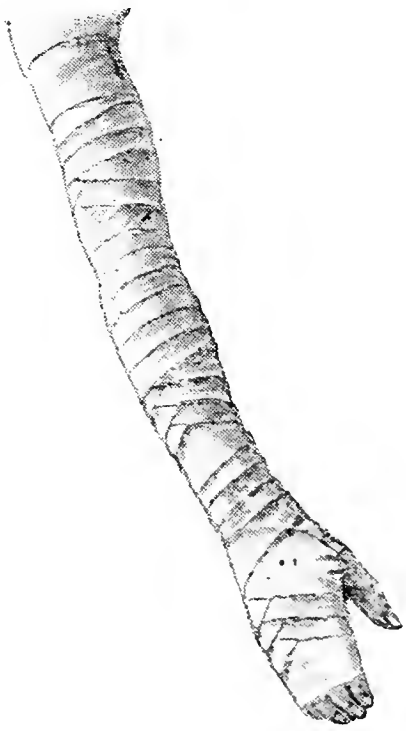


FIG. 45.



reached, when spiral turns take their place until the increasing diameter of the arm requires reversing upon. A few more spiral turns complete the bandage (Fig. 45). The elbow may be

covered, particularly if the forearm is to be retained in a flexed position, by figure-of-eight turns, as shown in Fig. 46, and presently to be described.

Uses.—To retain dressings and splints to the part, etc.

FIGURE-OF-EIGHT BANDAGE OF THE ELBOW.

2½ inches by 2 yards.

Fix the initial extremity by circular turns over the point of the elbow. After reaching the

FIG. 46.

front of the joint the third time carry the roller upwards, so that a turn shall be made which overlaps the fixing turns two-thirds, ascending. On returning to the front of the joint carry the roller downwards, so that a turn shall be made

which overlaps the fixing turns two-thirds, descending. Thus alternate above and below the joint with turns which continue to diverge from the olecranon, but overlap (approximately) in front of the elbow, until three complete figures-of-eight have been made, when the terminal extremity is pinned at the front (Fig. 46).

Uses.—To retain dressings and as part of the spiral reversed of the upper extremity.

SPICA BANDAGE OF THE THUMB.

ASCENDING SPICA.

1 inch by 3 yards.

Fig. 47.

Fix the initial extremity at the wrist, carry the roller to the tip of the thumb, and make a circular turn. Make a series of figure-of-eight turns of the thumb and wrist, overlapping (ascending) two-thirds; the intersections, or spicas, being made over the dorsum of the thumb (Fig. 47). Pin the terminal end at the wrist.

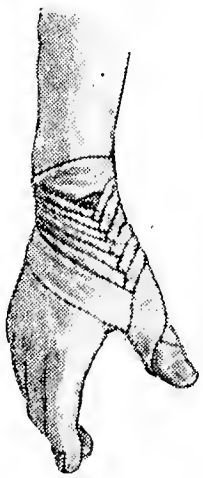
Uses.—To retain dressings and splints to the part.

DESCENDING SPICA

1 inch by 3 yards.

Fix the initial extremity at the wrist, carry the roller to the metacarpo-phalangeal joint of the thumb, and make a circular turn. Return to the wrist, and, with alternating thumb and wrist turns which overlap two-thirds, descend towards the tip of the thumb. Here also each spica should be made over the dorsum of the thumb. The terminal end is secured at the wrist (Fig. 48).

FIG. 48.



Uses.—To retain dressings, and after luxation of the base of the metacarpal bone of the thumb.

GAUNTLET BANDAGE.

1 inch by 5 yards.

Fix the initial extremity at the wrist, and carry the roller abruptly across the back of the hand to the tip of the index finger (if the right hand, to the tip of the little finger, if the left), and make a circular turn, after which the finger is ascended by a series of spiral turns. Some reverses are necessary if the fingers are œdematous, or if a very bulky dressing is to be retained, but ordinarily none. When the finger is covered, pass across the back of the hand to the wrist, and make here another circular turn. In like manner each finger is bandaged, and finally the thumb, when the terminal end is pinned at the wrist (Fig. 49).

FIG. 49.

Uses.—To retain dressings after burns and scalds. To apply splints. One or two fingers only are generally covered, the dressing as a whole being seldom used.

DEMI-GAUNTLET BANDAGE.

1 inch by 3 yards.

Fix the initial extremity at the wrist. Carry the roller across the back of the hand to the base of the index finger (if the right hand, to the base of the little finger if the left), encircle this, and return in the opposite direction across the back of the hand to the wrist. So continue until all have had this loop thrown over them, including finally the thumb, when the terminal extremity is pinned at the wrist (Fig. 50). Here, as in the gauntlet, it is better to make a complete circular turn of the wrist after each finger is covered.

FIG. 50.

Use.—To retain light dressings to the dorsum of the hand.

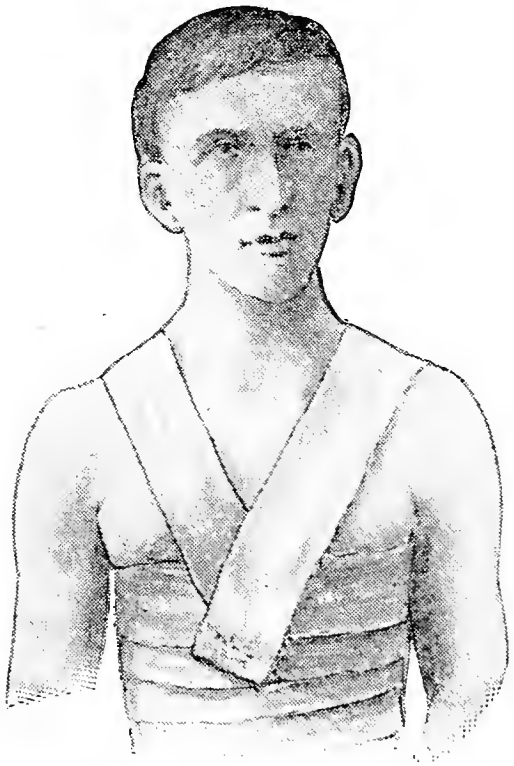
BANDAGES OF THE TRUNK.

SPIRAL BANDAGE OF THE CHEST.

3 inches by 7 yards.

FIX the initial extremity about the waist.

FIG. 51.



Ascend the chest by spiral turns, overlapping

one-half, until a point just below the axillæ is reached. At the sternum, recur across the right shoulder to the spine, and back across the left shoulder to the sternum. Secure each recurrent with a pin (Fig. 51).

Uses.—To support the chest, as after fracture of the ribs, or to retain dressings to it.

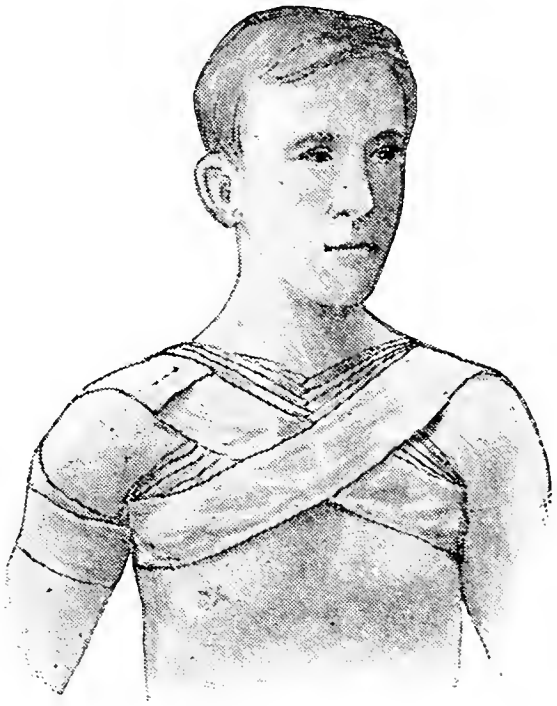
ANTERIOR FIGURE-OF-EIGHT BANDAGE OF THE CHEST.

2½ inches by 7 yards.

Fix the initial extremity on the upper part of the right arm, and carry the roller across the shoulder and front of the chest to the left axilla. Pass under this, over the left shoulder, and across the front of the chest to the right axilla. Encircle the right shoulder from below upwards, and return to the left side as before. So proceed until four or five turns have been made. These may repeat one another throughout, or may overlap three-quarters over the sternum.

The terminal end is secured at any convenient point in front (Fig. 52).

FIG. 52.



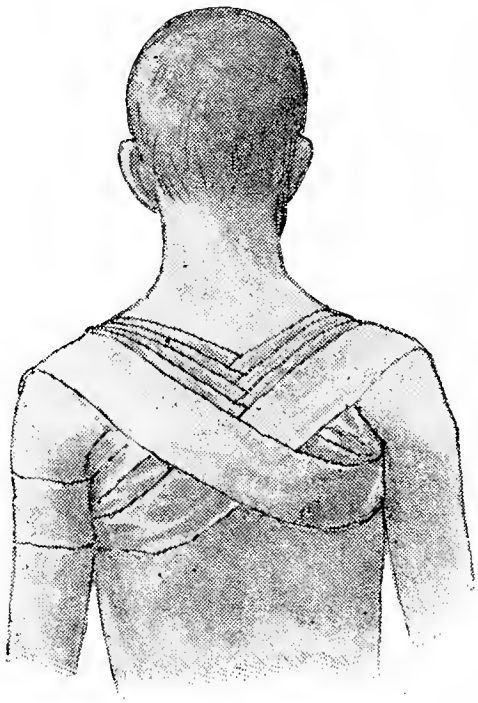
Uses.—To approximate the shoulders in front. To retain dressings.

POSTERIOR FIGURE-OF-EIGHT BANDAGE OF THE CHEST.

2½ inches by 7 yards.

Fix the initial extremity on the upper part of the left arm. Carry the roller over the summit of the left shoulder, and across the back to the

FIG. 53.



right axilla. Passing under this, and to the summit of the shoulder, again cross the back to the left axilla, where the left shoulder is encircled in the same way. After making four or five of

these turns, pin the terminal end in front. Each turn may repeat throughout, or overlap over the spine three-quarters, as shown in Fig. 53.

Uses.—To draw the shoulders together behind. To retain dressings over the upper part of the back.

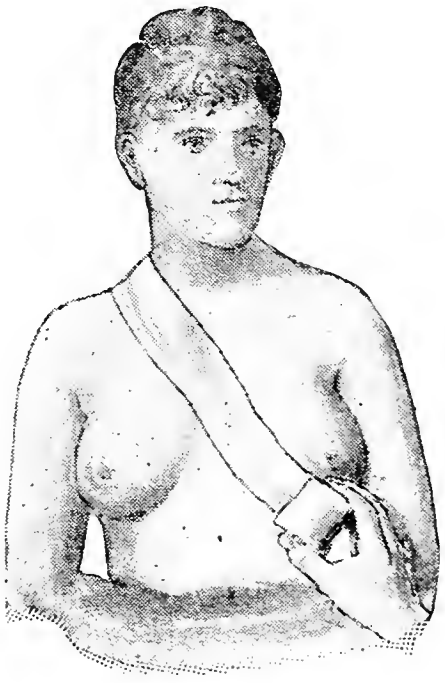
SPICA BANDAGES OF THE BREAST.

SINGLE SPICA.

2½ inches by 7 yards.

Place the initial extremity on the scapula upon

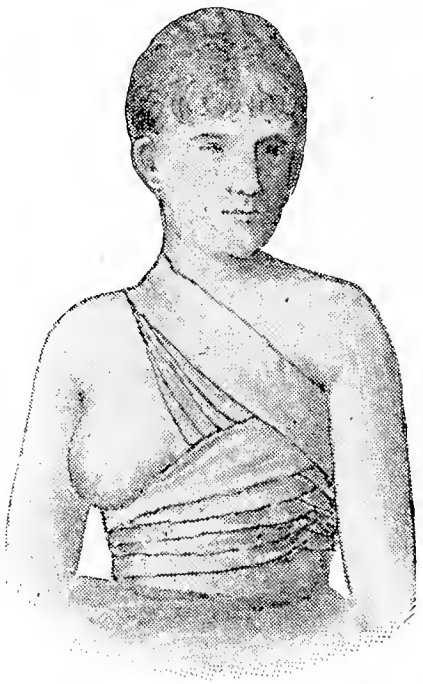
FIG. 54.



the affected side. Carry the roller across the

back to the summit of the opposite shoulder, and thence down under the lower portion of the affected breast, beneath the axilla, to the starting-point. Repeat this turn (Fig. 54) to fix the initial extremity. On reaching the scapula the second time, make the first circular turn around

FIG. 55.



the chest. This should pass under the sound breast and across the lower border of the affected breast. Having completed this circular, another shoulder turn is made, which overlaps the previous one three-quarters, ascending. Then another circular, which overlaps the preceding circular

one-half over the affected breast, three-quarters under the sound breast. So shoulder turns and circulars alternate, until the breast is thoroughly supported, when the terminal end may be pinned at any point in front (Fig. 55).

Uses.—To retain dressings to the part. To give support and produce compression.

DOUBLE SPICA.

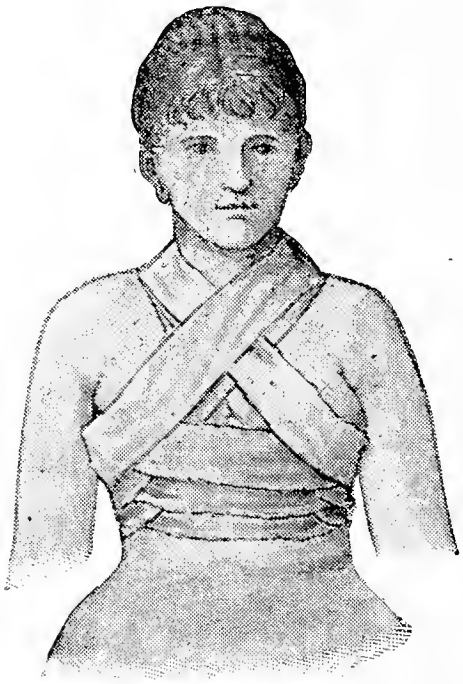
2½ inches by 10 yards.

FIG. 56.

The initial extremity is fixed in the same way as in applying the single spica (Fig. 54). On

reaching the left scapula the second time, carry the roller straight across the back to the right scapula, under the axilla and right breast to the opposite shoulder. Passing from here to the right scapula, the first circular turn begins. It should encircle the chest on a line that will include the lower border of both breasts (Fig. 56). When

FIG. 57.



this turn is completed, the roller passes to the summit of the right shoulder, and descends to include the left breast. Again it is carried across the back, under the right axilla, and ascends, including the right breast, to the left shoulder.

Then a second circular turn is made. In this way left breast, right breast, and circular turns alternate, the two former overlapping two-thirds, the latter one-half, until both breasts are covered. Three series of spicas are thus formed,—one over the sternum and one under each breast (Fig. 57). The terminal extremity may be pinned at any point in front.

Uses.—To retain dressings, and to give support and pressure to both mammæ.

BANDAGES OF THE LOWER EXTREMITY.

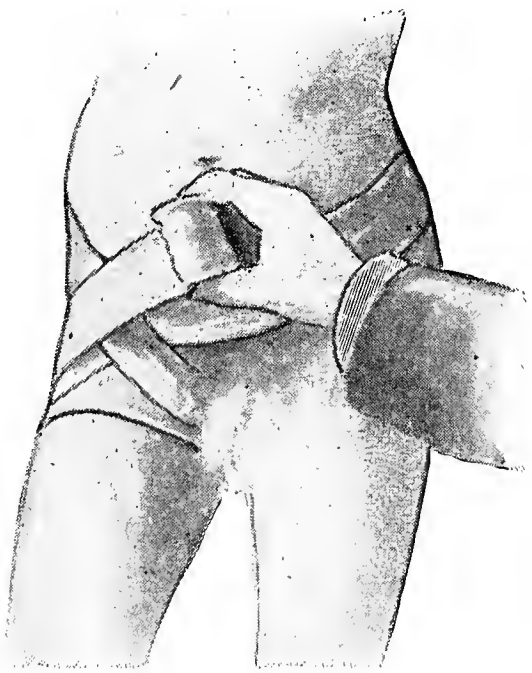
SINGLE SPICA BANDAGE OF THE GROIN.

2½ inches by 7 yards.

ASCENDING SPICA.

Fix the initial extremity about the upper part

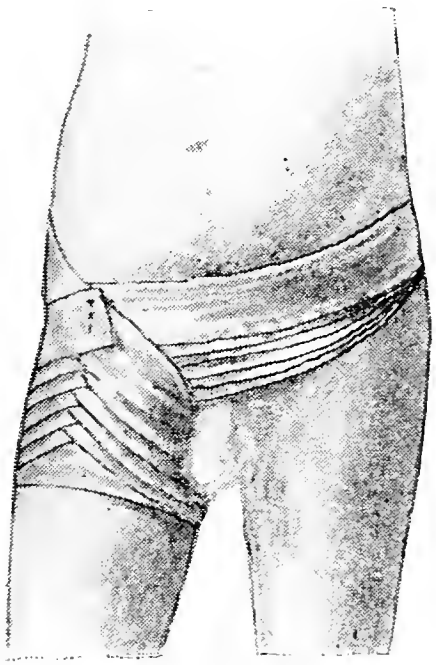
Fig. 58.



of the thigh, and carry the roller across the pubis to the crest of the ilium on the opposite side

(bandaging from left to right for the right thigh, and from right to left for the left). Thence around the body, return to the starting-point and encircle the thigh. As the lower border of the roller in each turn determines the position of the spica, it should intersect directly in front of the thigh and the roller be made to overlap two-thirds, ascend-

FIG. 59.



ing (Fig. 58). On crossing the pubis a second time the roller is made to converge towards the former turn, so that when it reaches the crest of the ilium it will repeat it. Proceed again to the thigh, and so continue until the bandage is exhausted. In securing the terminal end, thrust

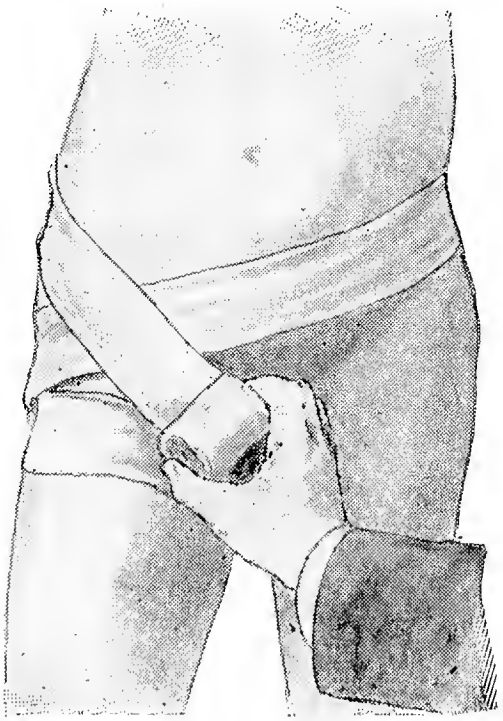
the pin in a sufficient depth to include any dressing which may have been applied, as the latter is very liable to become displaced (Fig. 59).

Uses.—To retain dressings to the groin. To keep herniæ restored; and to complete the application of splints to the thigh.

DESCENDING SPICA.

Fix the initial extremity at the uppermost portion of the thigh. Carry the roller across the

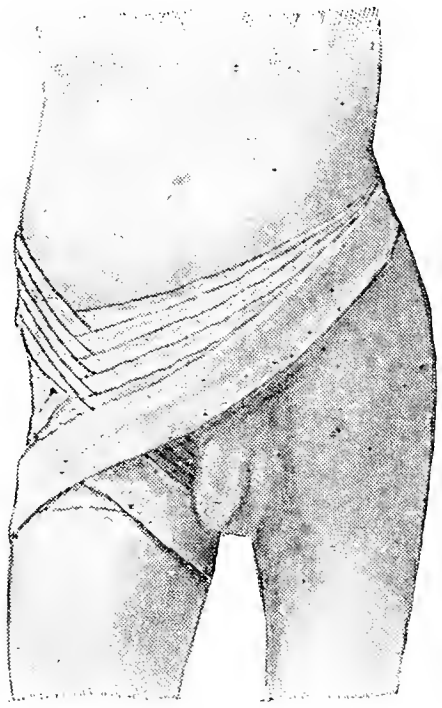
FIG. 60.



highest part of the abdomen which it is intended to cover, and proceed across the back to the groin.

In this bandage the upper border of the roller forms the spica, this turn, therefore, must cross the preceding one so that their upper borders coincide directly in front (Fig. 60). Encircle the thigh, overlapping, descending, two-thirds. Pass

FIG. 61.



the roller across the abdomen and make it converge towards the former turn, so that when the opposite side is reached it will repeat it, when it at once begins to diverge towards the groin. So continue until the roller runs out, when the terminal end is pinned deeply over the spica (Fig. 61).

Uses.—The same as the preceding bandage. It is

often not decided which of these to apply until after the first turn is made, when it may be determined to extend the turns above or below the fixing-point.

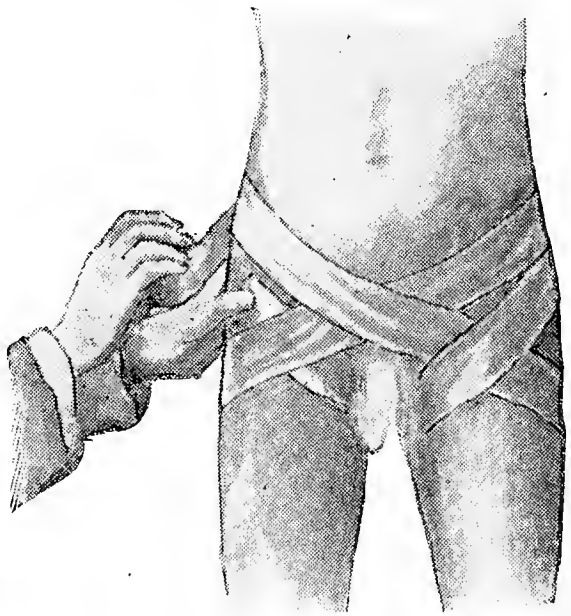
DOUBLE SPICA BANDAGE OF THE GROIN.

2½ inches by 10 yards.

ASCENDING SPICA.

Fix the initial extremity upon the upper por-

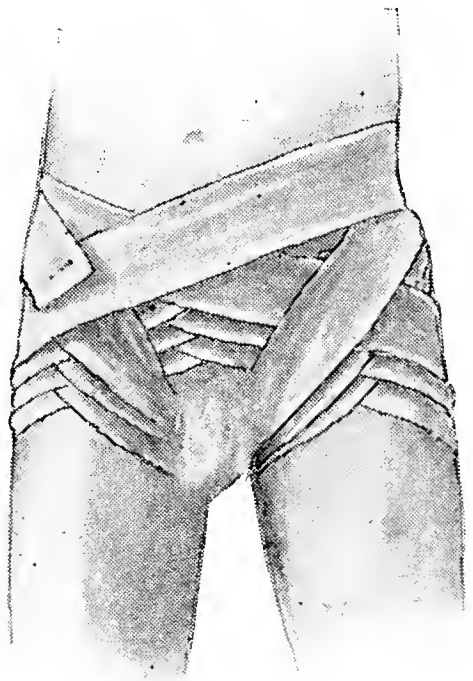
FIG. 62.



tion of the right thigh, or retain it with the thumb of the left hand until the first turn is made (the latter economizes the bandage). After

encircling the thigh, carry the roller across the pubis to the left iliac crest and straight across the back to the corresponding point on the right side. Passing over the pubis again, encircle the left thigh, and return by the back to the starting-point in front of the right thigh (Fig. 62). Three

FIG. 63.



spicas are begun in the first series of turns, and as each intersection of the lower border of the roller determines the location of these spicas, each must be made in its proper place in the median line of the abdomen and directly in front of each thigh. So continue overlapping two-

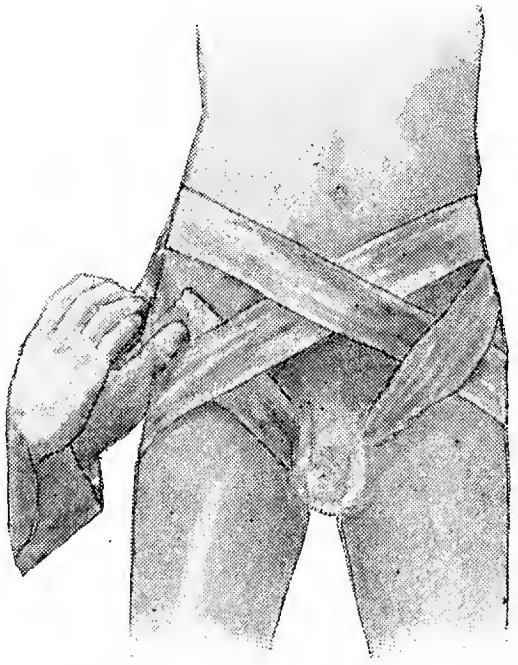
thirds, ascending in front and repeating behind, in the order right thigh, body, left thigh, body, right thigh, etc., until three or four complete turns have been made, when the terminal end may be pinned over a spica (Fig. 63).

Uses.—To retain double hernia. To make pressure or apply dressings to both groins.

DESCENDING SPICA.

Fix the initial extremity on the uppermost por-

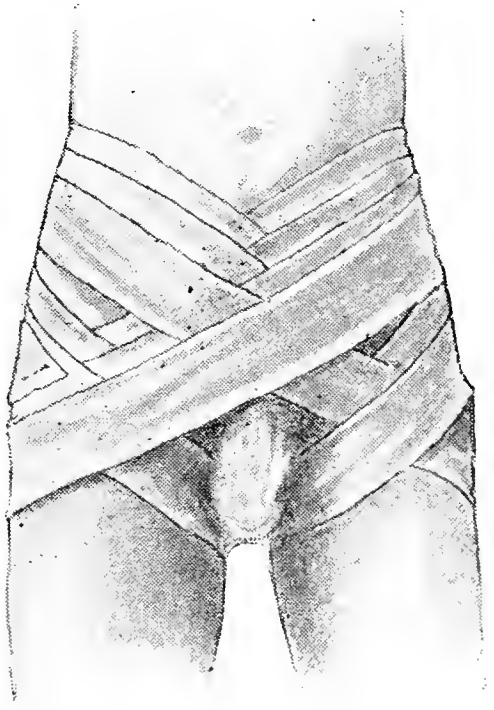
FIG. 64.



tion of the right thigh, or retain it with the thumb of the left hand until the first turn is

made. Having encircled the thigh, carry the roller across the highest part of the abdomen, which is to be covered, to the opposite side. Cross the back horizontally, and descend over the abdomen to the left thigh and encircle it. Convey the roller again across the back, descending on

FIG. 65.



the right side to the starting-point over the right thigh (Fig. 64). Here, as in the preceding dressing, there are to be three spicas. The intersection of the upper border of the roller in the median line and in front of each thigh determines the position of each spica. So proceed, overlap-

ping two-thirds, descending in the order just described for the ascending spica, until three or four complete turns have been made, when the terminal extremity may be pinned over either spica (Fig. 65).

Uses.—The same as the preceding bandage. Whether to employ one or the other is often decided, as in the single spica, after the first turn is made.

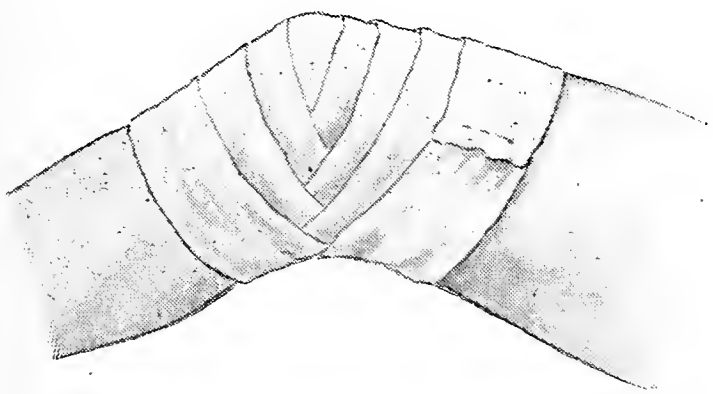
FIGURE-OF-EIGHT BANDAGE OF THE KNEE.

2½ inches by 2 yards.

Fix the initial extremity by circular turns over the patella. After reaching the popliteal space the third time carry the roller upwards, so that a turn shall be made which overlaps the fixing turns two-thirds, ascending. On returning to the back of the joint carry the roller downwards, so that a turn shall be made which overlaps the fixing turns two-thirds, descending. Thus alternate above and below the joint with turns which continue to diverge from the patella, but overlap (approximately) at the popliteal space

until three complete figures-of-eight have been made, when the terminal extremity is pinned at any point (Fig. 66).

FIG. 66.



When this bandage is used as a part of the spiral reversed of the lower extremity, a slight modification in the lay of the initial, and terminal turns becomes necessary.

Uses.—To retain splints and dressings to the knee-joint, and as a part of the spiral reversed bandage of the lower extremity.

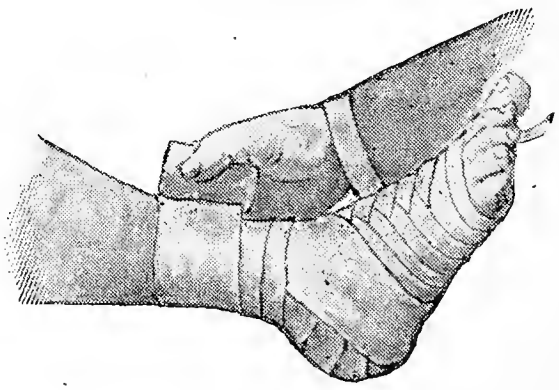
SPICA BANDAGE OF THE FOOT.

2½ inches by 3 yards, for the foot alone.

Fix the initial extremity at the ankle, and con-

vey the roller abruptly across the dorsum of the foot to the base of the toes. Around the foot at this point make a circular turn, then a spiral, and proceed to the heel. The roller crosses the latter at a point which will bring its lower border on a level with the sole of the foot. Thence return across the dorsum and make the first spica. The lower border of the roller being the guide for the proper location of the spica turns (as this is

FIG. 67.



an ascending spica), it must intersect the lower border of the preceding turn in the median line of the foot and overlap three-quarters, ascending. Unlike all other spicas, this ascending overlap does not converge at any point, but continues a three-quarter overlap throughout the entire course of each turn, behind the heel, as well as around the foot. Another foot turn being

completed, the roller is carried to the heel. So foot and heel turns alternate until the former is completely covered, and the latter, except its point (Fig. 67). The terminal end may be pinned at any convenient point, or the bandage continued up the leg.

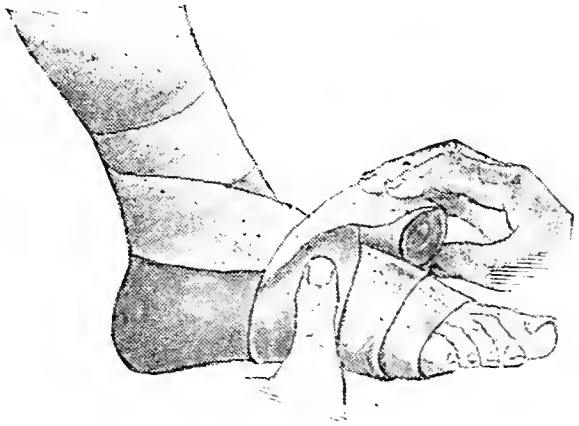
Uses.—To retain dressings to any part of the foot. To make pressure or give support. Also to commence the spiral reversed bandage of the lower extremity.

INCOMPLETE BANDAGE OF THE FOOT.

2½ inches by 2 yards, for the foot alone.

Fix the initial extremity, and carry the roller

FIG. 68.



across the dorsum of the foot, as in the preceding dressing. Make one circular, one spiral, and

one spiral reversed turn around the foot, overlapping two-thirds, ascending (Fig. 68), and proceed across the instep to the ankle. Here make a circular, and again crossing the instep, make another foot turn. The ankle and foot each receive another turn, overlapping the preceding one

Fig. 69.

two-thirds, when the terminal end is either pinned at the ankle or the roller continued up the leg (Fig. 69). The heel is not covered.

Uses.—To retain dressings, and to commence the spiral reversed bandage of the lower extremity.

COMPLETE BANDAGE OF THE FOOT.

2½ inches by 3 yards, for the foot alone.

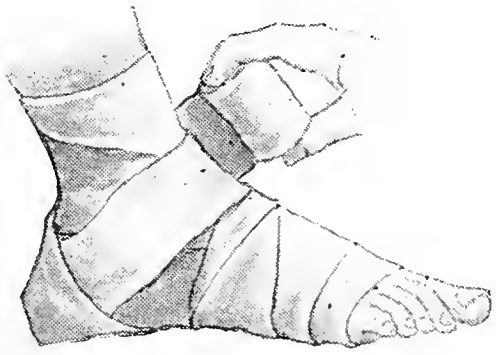
Fix the initial extremity, carry the roller across the foot, make a circular turn, a spiral, and a

spiral reversed, all as in the dressing just described. Starting, after these turns have been made, at the instep, carry the roller across the

FIG. 70.

point of the heel back to the instep (Fig. 70). From here pass to the sole of the foot, and around the side of the heel under the malleolus (the

FIG. 71.



outer, if the right foot, the inner, if the left) to the tendo Achillis (Fig. 71), and to the instep. Again to the sole of the foot, beneath the other malleolus to the tendo Achillis, and back to the

instep (Fig. 72). The terminal extremity is either pinned here, or the roller carried up the leg. The turns under each malleolus must also be pinned. This bandage covers the heel.

FIG. 72.

Uses.—To retain dressings, and make uniform pressure upon the ankle-joint. Also to commence the spiral reversed bandage of the lower extremity.

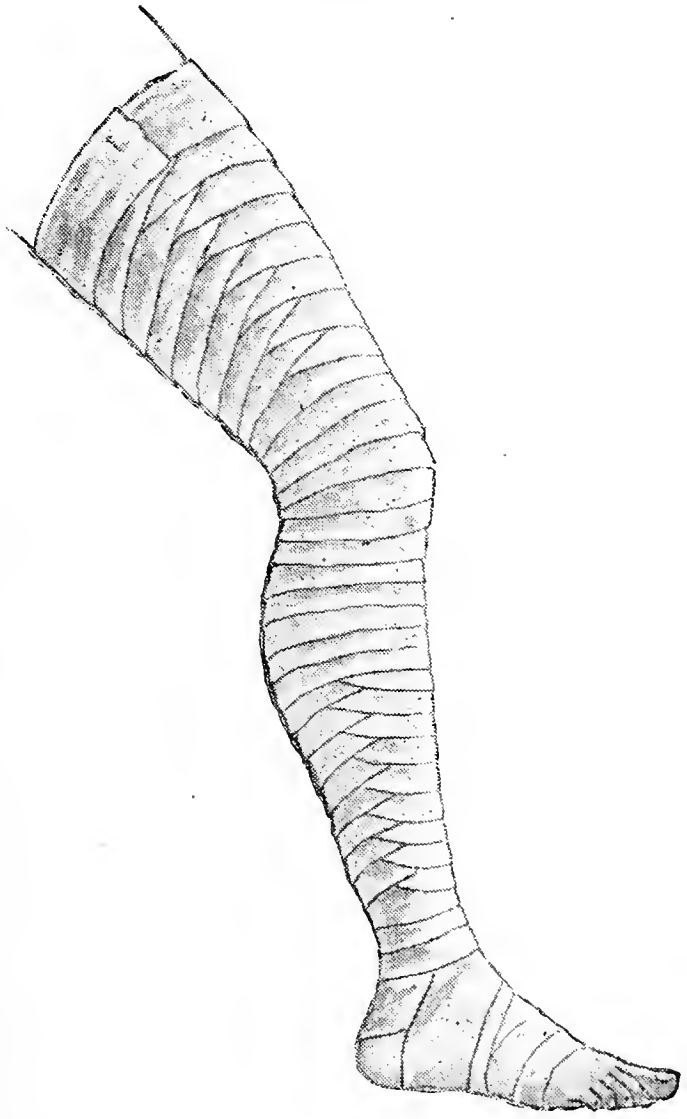
SPIRAL REVERSED BANDAGE OF THE LOWER EXTREMITY.

2½ inches by 7 yards to the knee, 14 yards to the groin.

Fix the initial extremity, and cover the foot by either of the three methods above described. After the foot has been covered, proceed with spiral turns, overlapping two-thirds up the leg,

until its increasing diameter necessitates reverses. After which spiral turns, or if the calf be very

FIG. 73.



much swollen or a bulky dressing has been applied to it, descending spiral reverses, continue until the knee is reached. The terminal end is here pinned. If the roller is to be carried up to

the groin, figure-of-eight turns will be made to cover the knee (see page 85), and spirals and spiral reverses, as indicated by the contour of the limb, will complete the dressing (Fig. 73).

Uses.—To retain dressings, splints, extension apparatus to the part, and to give support for various conditions.

SURGICAL DRESSING.

SURGICAL DRESSING.

Surgical Cleanliness.—This is an essential condition upon which depends every detail in the management of wounds. It is obtained by removing or destroying all pathogenic micro-organisms and their spores from the wound itself, and from everything which is to be brought in contact with it directly or indirectly. The several processes for removing such organisms are called sterilizing. They will be briefly referred to in their application to the dressing of wounds in their appropriate place. Steps in the direction of surgical cleanliness which cannot, however, be too greatly emphasized here are general neatness and cleanliness of person and surroundings of the surgeon, and his unceasing watchfulness to prevent the occurrence of some careless act or some omission, by himself or his assistants, which will jeopardize the

good results of all his painstaking preparations and precautions. As a preparatory measure, too, the removal of all coarse, apparent dirt from one's hands, from instruments, apparatus, and from the wound is necessary before sterilizing agents are employed.

Sterilizing Water and Solutions.—As water from any source from which it is commonly obtained is liable to contain pathogenic micro-organisms, it should be put through some process which will render it sterile before it is used either for cleansing wounds or for lotions and solutions. Boiling for ten minutes accomplishes this result without fail, provided the water is made to really boil. Corrosive sublimate and other chemical agents are also effective, the former being the most reliable. Distillation and filtration, when they are practicable, are also very useful processes. Water should be prepared before use for solutions, even though the agent to be added to make the solution is a chemical germicide.

Disinfecting the Hands.—It is desirable that the habit should be formed of preparing the hands as carefully for the purposes of dressing a wound

as they are for operating. As the skin of the hands is much more easily made clean when it is smooth and soft than when it is rough, horny, or chapped, it is important that surgical hands should be kept in nice order. To do this is, of course, difficult when they are constantly immersed in sublimate solution, permanganate of potassium, oxalic acid, and plaster of Paris, and particularly in cold weather. Under the nails, always a troublesome place to keep clean, the constant use of these materials is especially manifest. But even here, if the rule is observed never to use anything but a brush, the epithelial surface beneath the nail is kept so smooth that it will not retain foreign matter. Even an ivory point should, in my opinion, never be used, much less the blade of a knife or the point of scissors. Vaseline upon the hands at night, and even once or twice through the day, if the least roughness appears, will usually keep them smooth, and if they are smooth they may be kept clean. Of the various methods of sterilizing the hands, one which is simple and effective may be sufficient to mention. After moistening them with turpentine, the forearms

and hands are scrubbed with a nail-brush and soap. The scrubbing should last several minutes, and the soap rinsed off and used again two or three times; the final rinsing should remove the soap very thoroughly. The hands and forearms should then be placed in a sublimate solution—1 : 1000—for two or three minutes, the solution being meanwhile rubbed well into the finger-tips and nails. The hands are then prepared, except in cases involving organs or cavities, which preclude the use of corrosive sublimate, when they may be washed in alcohol and receive a final rinsing in distilled water.

It must be borne in mind that, in order to preserve the condition of surgical cleanliness thus obtained, hands so prepared must touch literally nothing that is not sterilized. The operator, the assistant, or the nurse, whose hands are prepared, cannot rub an eye, or scratch a forehead, or touch clothing, an instrument, a dressing, or a tray; if he does so thoughtlessly, he must, to be consistent in his aseptic principles, resterilize his hands before touching a wound. What is true of the hands is, of course, equally true of every substance which comes in contact

with the wound. As steel is more easily sterilized than skin, foul dressings from suppurating, gangrenous, and malignant sores are best removed with dressing forceps. Such nests of infection may be cleansed and dressed without the fingers having come in contact with any part of them.

Apparatus for sterilizing Dressings and Instruments.—Though many devices are used for this purpose, a very simple affair can be constructed by a coppersmith or a tinsmith after the manner suggested by Schimmelbusch. A rectangular water-tank of the required shape and dimensions (12 inches long, 6 inches broad, and 3 inches high is a convenient size), mounted on four feet and fitted with a movable lid, has resting upon it a box with an open bottom and a nicely fitting lid. Heat is supplied by a lamp or gas-jet, and, while instruments are being boiled in a soda solution in the tank, dressings are receiving their steam sterilization in the upper compartment. Instruments are conveniently placed in a wire tray to be boiled and dressings in wire baskets or perforated metal boxes. To be effective, boiling must be active

and the process should be continued for three-quarters of an hour. The lids of the boiling-tank and the steam superstructure should fit closely enough to only allow of the escape of steam under some pressure.

Materials and Appliances. Gauze.—The material used for the purpose of covering a wound which has been found to possess the best qualities for making easy, comfortable pressure and absorbing exudations is gauze. It can be folded, refolded, and cut into various sizes and shapes as required. It may be used dry, slightly moistened with a solution of corrosive sublimate, or saturated with iodoform. When used dry, its bibulous properties may be much improved by covering it with wax-paper, oil-silk, or gutta-percha tissue.

The wound being assumed to be ready for the dressing,—*i.e.*, closed, dry, and clean,—may almost without exception be appropriately dressed with gauze. In order that a definite idea may be formed regarding the proper size to make the pad of gauze for any particular wound, it may be well to state a formula as follows: A simple, incised wound, resulting from either injury or

operation, if one inch long, should be dressed with a mass of gauze two inches square and one-eighth of an inch thick. A wound eight inches long, after amputation, for example, would require a dressing sixteen inches square and one inch thick. The area of the dressing, therefore, would be in square inches the length of the wound multiplied by two, and its thickness would be equal to the length of the wound divided by eight. Two hundred layers of gauze, moderately compressed, are an inch in thickness, Twenty-five layers, therefore, would, according to the formula, be used for the small wound, while two hundred layers would be required for the larger. This formula is based upon average requirements, and is intended only to give distinct data in a matter which is usually treated somewhat vaguely. Upon the pad of gauze is placed a layer of absorbent cotton of like bulk, and the dressing thus completed, if no oil-silk or tissue be used, is retained in position by turns of a gauze, muslin, or flannel bandage appropriate to the part dressed.

Gauze, muslin, and all such fabrics may be sterilized (*a*) by immersion in sublimate solu-

tion of the strength of 1 : 1000, (*b*) by boiling for twenty minutes in a solution of carbonate of soda, ʒii to Oi, or, still better, (*c*) by steam, when the means and time are at hand for its employment. Such materials should be cut and folded ready for use and wrapped in separate parcels before sterilization if the latter process be used.

Absorbent Cotton.—Absorbent cotton sterilized as gauze, by steam heat, is used outside of the latter to give easy pressure upon the wound, and for many other purposes. Pads made of it may be saturated with corrosive sublimate solution, alcohol, or distilled water for cleansing purposes.

Oil-Silk. Gutta-Percha Tissue. Wax-Paper.—Either of these materials may be used for retaining moisture within dressings. When used upon a wet dressing they must completely cover the latter to insure the retention of its moisture. The two former can be sterilized by corrosive sublimate, the latter cannot.

Surgical Cement.—Small wounds and abrasions can frequently be sealed by moistening a scrap of cotton or a single layer of gauze with tincture

of benzoin or collodion. A compound consisting of collodion to which benzoin has been added is, however, the most useful cement. One drop placed upon a wound immediately covered with a delicate film of absorbent cotton, which is made to adhere by brushing it down with a camel's-hair pencil, is an effective dressing for a variety of small wounds, particularly of the scalp. Benzoated collodion poured around the edges of a large gauze dressing retains the latter in accurate position, controls movement, and, in wounds about the genitals, as after herniotomy, is an effective means of damming off septic fluids and gases. It is prepared in the following manner: To one ounce (avoirdupois) of gun-cotton seven ounces of alcohol are added; if shaken frequently for ten minutes the alcohol will be found to have macerated the gun-cotton into the consistence of paper pulp. To this mixture three ounces of fluid extract of benzoin are added, and again well shaken, when the compound is completed by the addition of twenty-four ounces of sulphuric ether. Corrosive sublimate added in the proportion of 1 : 2000 renders it sterile.

Catgut.—Whether used for ligation, suture, or drainage, catgut requires careful sterilization. This may be done by soaking it a day in juniper-berry oil and afterwards transferring it to absolute alcohol, or better, by exposing it to a high temperature in a fluid which boils at a much higher temperature than water, and does not macerate and weaken the gut, as xylol or cumol. It is absorbed in about ten days.

Silk.—After being wound on glass reels, it is placed in a test-tube and sterilized by steam one hour for three successive days; the end of the test-tube is plugged with sterilized cotton. The silk should, of course, be resterilized if the tube is opened.

Silkworm-Gut.—After being carefully washed, should be boiled half an hour before being used. It is not absorbed by the tissues.

Iodoform Gauze.—Iodoform, sterilized by being washed in a solution of corrosive sublimate, is rubbed into moist sterile gauze which has been cut into strips about one inch wide. Thus prepared, it is kept in a closely-stoppered jar or tube which retains its moisture and is placed in a dark closet. *Iodoform*, *aristol*, *acetanilide*, and

boracic acid can be conveniently kept in small vials, or in test-tubes screened with gauze.

Drainage Tubing.—Rubber tubing, after being scrubbed well with soap and water and rinsed in boiled water, is allowed to soak in 1 : 1000 bichloride solution for twenty-four hours, after which it is placed in carbolic solution, 1 : 20, for twenty-four hours, and finally kept in three per cent. solution of carbolic acid.

Instruments.—A glass syringe, with a capacity of two ounces, a pair of dressing forceps, a razor, a groove-director, a probe, a pair of straight scissors, and a pair of bandage scissors constitute the instruments ordinarily required. After removing all the foreign matter which can be seen from teeth, joints, and interstices, they are scrubbed with soap and carefully rinsed; they then should be boiled for half an hour in a strong solution of carbonate of soda. Thus cleansed, they are placed in a clean porcelain tray, either dry or immersed in sterile water.

Sponges.—Small sponges of rather fine grain require an elaborate process to properly prepare them for surgical use. They should be soaked twenty-four hours in a solution of mu-

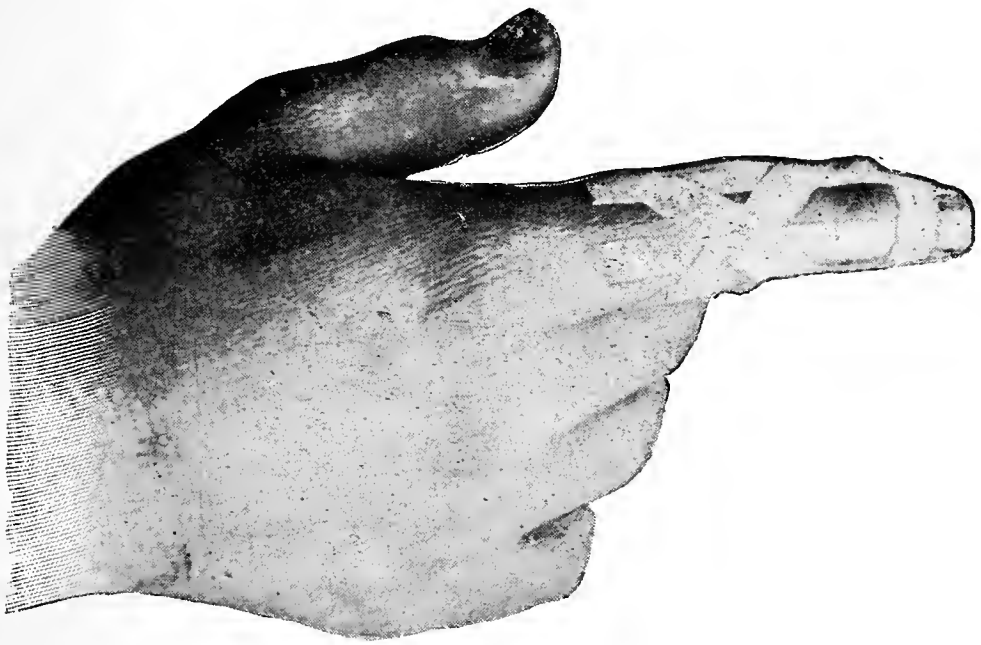
riatic acid, 1 : 15. Then, after being washed thoroughly in cold water, they are immersed for five minutes in a solution of permanganate of potassium, 1 : 500. Wrung out dry with the hands, they are then allowed to soak for four hours in a solution consisting of half a drachm of sulphuric acid and four and a half drachms of oxalic acid to the pint of water. They are then washed in sterile water and stored in solution of carbolic acid of three per cent. or of corrosive sublimate 1 : 1000.

Pads of absorbent cotton or gauze are usually to be preferred to sponges; the former for cleansing purposes, the latter for absorbing blood during operations.

Adhesive Plaster.—Adhesive plaster is used for the treatment of wounds much less than formerly. It possesses qualities, however, which make it a very useful dressing in such conditions as require positive, unyielding pressure or traction. For wounds it is far better than rubber plaster, because it can be sterilized readily and because it does not adhere so fast on removal. It is heated for use either by contact of its muslin side with a vessel containing boiling water or by being slowly

swayed, face downwards, over an alcohol flame. By the latter method heat sufficient to render it sterile is readily applied. Through the pressure it exerts it crowds down exuberant granulations and relieves chronic œdema and indura-

FIG. 74.

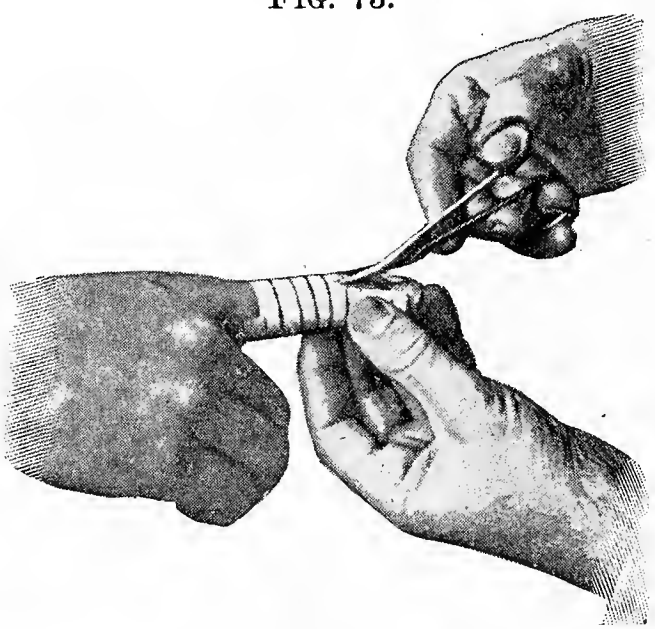


Method of strapping finger.

tions. By its traction it relaxes tension. It may, therefore, be appropriately used in the treatment of many ulcers, of chronic cellulitis, of cellular infiltration, and of granulating wounds, particularly when small. Describing a few of its more common methods of application, a one-quarter inch-strap applied in the manner shown in Fig.

74 is useful for many minor injuries of the fingers. It consists of two recurrent turns—an antero-posterior and a lateral recurrent—and an oblique turn, sweeping from the base of the finger to and around the tip and back to the base. A more satisfactory method of strapping

FIG. 75.

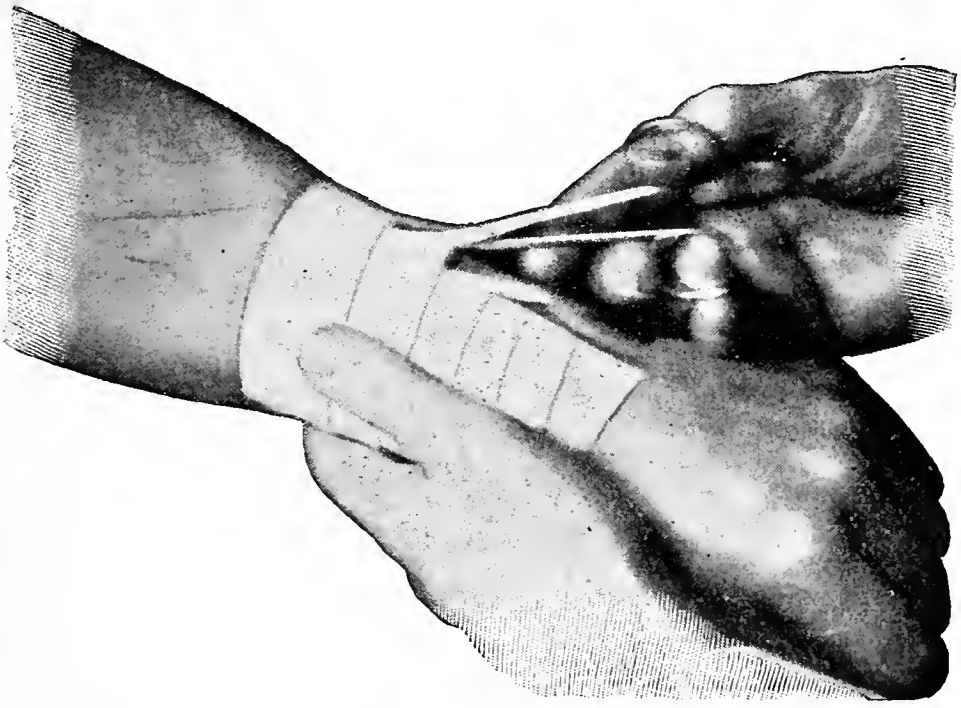


Slit-spiral of finger.

fingers is by the slit-spiral. A quarter-inch strap is applied from the tip of the finger to its base in a spiral so tight that, uncut, it could not be borne. It is then slit up through its entire length with delicate scissors, as shown in Fig. 75, at a point opposite the wound, or at the dorsal side of the finger. By this means each

turn becomes a separate spiral, and all give firm, very equable pressure and control the movements of the finger, without the least risk of interfering with its circulation. This form of strapping is also applicable at times to the wrist

FIG. 76.



Slit-spiral applied to forearm.

(Fig. 76) and lower third of the leg with one-inch straps, but is manifestly inappropriate if the part to be strapped is conical. At the middle of the leg, a common seat of ulcers, one-inch straps, overlapping one another one-half their width and occupying an area three-quarters

the circumference of the limb and from a point about three inches below the ulcer to one three inches above, are applied from below upward. In the application of these straps care should be taken to draw the upper edge of each so firm that the next strap will not cause this border to become puckered. Puckered adhesive plaster will make sound skin sore. To prevent this, therefore, the upper border of each strap should be firm, its lower slack. The same precaution is necessary in strapping the chest for fracture of the ribs. Here the area to be covered extends from the base of the chest to the axilla, and from a point three inches from the median line on the sound side in front to a corresponding point behind. Two-inch straps are used. Anchor one end of a strap at the lowest point either behind or in front. The patient is directed to breathe out as fully as possible, meanwhile steadying himself with the arm on the sound side. At the moment expiration is complete, the strap is laid horizontally with considerable force, its upper border dipping quite deeply into the skin. The same manœuvre is repeated for each successive strap, until about

six are applied, overlapping one another one-half their width. The skin should always be shaved before the application of adhesive plaster.

PREPARING THE WOUND.

A wound after operation needs no preparation before dressing, as it and the skin in its vicinity are already sterile. A wound caused by accident, on the other hand, requires careful attention, apart from the appropriate treatment indicated by its nature, to prepare it for dressing. The skin around it should be scrubbed with warm water and soap and almost invariably shaved, even though the growth of hair be imperceptible, as shaving is a most effective means of removing dirt. A solution of corrosive sublimate 1 : 2000, if the wound is of simple character, is washed freely over the wound and adjacent skin and the part is protected by sterilized towels or cloths. If alcohol or ether be employed to remove grease from around the wound, they must be used sparingly and with care to avoid their entrance into the latter, as they cause great pain. Indeed, the necessary manipulation incident to properly preparing any

wound of considerable extent involves so much pain that it is frequently desirable to use an anæsthetic at the start.

Redressing the Wound.—The too frequent changing of dressings does harm. As a very important part of the successful management of wounds depends upon changing the dressings at the proper time, and as the period through which they may remain undisturbed varies from hours to weeks, the indications for removal of a dressing should be most carefully noted. If a dressing causes pain it should be removed. Pain usually depends upon pressure either outside of the wound by too great tension of the bandage or pressure within the wound by accumulation of pus or blood. If the pain is caused by the former, immediate relief is given by simply removing the bandage and reapplying it; if the pain arises from the condition of the wound itself, free drainage and the removal of all tension by dividing any constricting suture will accomplish a like result. When any odor can be detected, even though the dressing looks clean on its exterior, it should be removed. When pus, blood, or serum appears at the sur-

face of the dressing, even though there is no odor, the dressing should be changed. In extensive wounds, those resulting from serious injuries or after operations, a very important guide to the condition of the wound is the patient's temperature. This should be frequently recorded; and if there is any fever which cannot be ascribed to another cause, the dressing should be at once removed.

In preparing to remove a dressing, the same care should be observed to prevent infection as when the wound was first dressed. The bedding is protected by a rubber sheet, upon which is spread a sterilized towel. The hands should be resterilized after cutting the bandage and removing the cotton padding down to the gauze. The folds of gauze are then carefully lifted up, beginning with those which are the most remote from the wound. If it is found to adhere it may be moistened with corrosive sublimate solution, or, if the nature of the wound negatives this, with distilled water. If the dressing has been so saturated with blood or pus that it is not readily softened, peroxide of hydrogen will be found very useful. A small quantity poured

between the gauze and skin quickly finds its way over the whole surface covered by the former. The volumes of hydrogen generated by its decomposition lift up the most tightly adhering dressing without pain to the patient or damage to the wound. The wound is then washed with pads of cotton wet with an appropriate solution, or, being entirely free from suppuration, may be allowed to remain dry, and thus be redressed.

DRESSING OF INCISED WOUNDS.

An incised wound is expected almost invariably to heal by primary union. This statement is made with the understanding that the incision does not communicate beneath with some condition inimical to this process. An incision into an appendicular abscess cannot be regarded in any sense as possessing the characteristics of an incised wound; no more can a clean cut over a necrotic tibia be so regarded, or a perineal section into the bladder or urethra. An incised wound, therefore, surgically speaking, is one made by a clean, sharp instrument, or one made by a sharp instrument depositing a certain

amount of foreign matter, which is either not septic in character or, being septic, can readily be removed by appropriate means from the wound before the latter is properly closed. Properly closed, namely, with the edges of integument brought into nice apposition, such a wound, as has already been stated, requires only that it should be kept clean and at absolute rest to heal immediately. The appropriate dressing, therefore, for an incised wound is a pad composed either of gauze or some similar material, supplemented by a mass of absorbent cotton or wool, and retained in position by the application of a gauze bandage. If of an extremity, all the parts adjacent to the wound, which by their movement can at all disturb the latter, should be kept at rest by the application of a suitable splint. Further rest is given the affected parts by the gentle pressure of the controlling bandage, which puts at rest all spasmodic movements of muscular tissue possibly involved in the injury, which are local in character and not sufficiently controlled by the splint.

LACERATED AND CONTUSED WOUNDS.

An injury which inflicts a wound of this nature necessarily involves a greater or less destruction of tissue. The extent of this destruction varies according to the force and method of application of the inflicting body from a mere abrasion of the skin to the crushing off of a limb by a car-wheel or machinery. Antiseptic surgery modifies suppuration, but does not prevent it. It modifies suppuration by arresting the septic influence of the necrotic upon the healthy tissues. Destroyed integument, fasciæ, and muscle will not heal without suppuration; they must be made to heal, therefore, after exfoliating the dead without infecting the living. A contused wound seldom bleeds. Its surface is apt to be dry, parched, and charred, and frequently contains some variety of foreign matter, as earth, machinery oil, gunpowder, or dynamite. The edges of such a wound, if possessing hair, should first be shaved. Under a douche of corrosive sublimate solution, at a temperature of 100° F., the wound should be carefully felt with the fingers, and any foreign matter which

cannot be removed with a sponge should be scraped out with a curette. Filling the wound with a mass of dry gauze, held in place by firm pressure of the hand, the surrounding parts should be carefully dried. Removing the gauze, the surface of the wound, freed from any considerable bleeding, is dusted freely with aristol, iodoform, or acetanilide, dressed with a pad of gauze, and covered with wax-paper. A lacerated wound differs little in character from a contused wound. It is, however, more apt to possess a flap or mass of integument, the vitality of which is not destroyed, and which, after restoration and approximation, will unite without sloughing. To insure union, such flaps must be very carefully cleansed, gently handled, and neatly approximated. Lest suppuration beneath the flap be allowed to accumulate and jeopardize its life, some form of drainage, either a small tube or a few strands of catgut, should be inserted at opposing angles of the wound. A dressing similar in all respects to that used for contused wounds is appropriate for lacerated wounds.

GUNSHOT AND PUNCTURED WOUNDS.

Possessing certain salient characteristics in common, though differing widely in details, the dressing of gunshot and punctured wounds may be described together. Apart from the special importance attaching to these wounds, when they involve a viscus, vessel, or bone, they possess one character in common which distinguishes them from other wounds, and necessitates a special attention for its proper management,—*i.e.*, imperfect drainage. The entrance of a bullet, or chisel, or spike many inches into the tissues, conveying with it perhaps foreign matter more or less septic in character, forms a canal straight or tortuous to the depth of the penetration of the body inflicting the wound. The canal thus formed does not remain patulous; its walls collapse, and, owing to the change in the relative attitude of muscles to fascia, and fascia to skin, it ceases to be continuous. There are two sufficient reasons, therefore, why any products of inflammation fail to escape through the orifice of the opening. Failing to thus escape, deep and dangerous suppuration may

ensue. The exterior dressing will therefore be seen to form a very unimportant part in the management of such wounds. Drainage is principally to be relied upon. In wounds extending a considerable distance into a part, the bottoms of which can be sounded by a probe, a great safeguard against future trouble is the introduction of a few strands of catgut carried to the bottom of the wound on a fork-end or flattened probe. This, supplemented by daily injections of peroxide of hydrogen for a period of five or eight days, will conduct the wound through the perilous stage. Exteriorly it may be dressed well with wet corrosive gauze and wax-paper. During the treatment, the adjacent parts, including the proximal joints, if of an extremity, should be kept absolutely at rest.

Gunshot and punctured wounds which transfix a part, as the hand, forearm, or thigh, rarely give any trouble of a septic or inflammatory nature, as in them through and through drainage is practicable. For this reason punctured wounds which, as revealed by a probe, have almost transfixed had better be made to completely transfix by a small incision at the point

indicated by the presence of the probe beneath the integument. Two or three strands of catgut, or, in larger wounds, a light strip of iodoform gauze or a small rubber tube, carried completely through, insures the cleansing of the entire wound.

FIXED DRESSINGS.

A fixed dressing may be defined as one which forms a more or less firm casement about a part. The mere coating of a muslin bandage with starch, glue, or silicate of sodium constitutes the simplest form of fixed dressing, and is sometimes useful in retaining the bandage properly in place with delirious or refractory patients. When two or three successive bandages are applied in this way, each coated in turn, a case firm enough for a fracture is readily made. Plaster of Paris, however, is the most useful material with which to make fixed dressings. It is commonly employed thus:

Preparation of Plaster-of-Paris Bandages.—Crinoline is cut into strips two and a half inches wide and seven yards long, and rolled into loose bandages. Unrolling the initial extremity of one of these, dry plaster of Paris, as shown in Fig. 77,

is spread upon it with a spatula in a layer a sixteenth of an inch thick. A yard or more of the bandage, according to the size of the table used, being thus spread, is rolled into a cylinder, care

FIG. 77.

Mode of making plaster bandages.

being taken to retain as much of the plaster as possible. The next portion is spread and rolled in a similar manner, and so the process is continued until the entire bandage is completed, with a layer of plaster between each turn. A rubber band holds it together, and it is wrapped in wax-paper ready for use.

Mode of Application of Plaster-of-Paris Bandages.—The bandage is completely submerged, standing on end, in cold water. When it ceases to yield bubbles, it is to be removed and pressed as

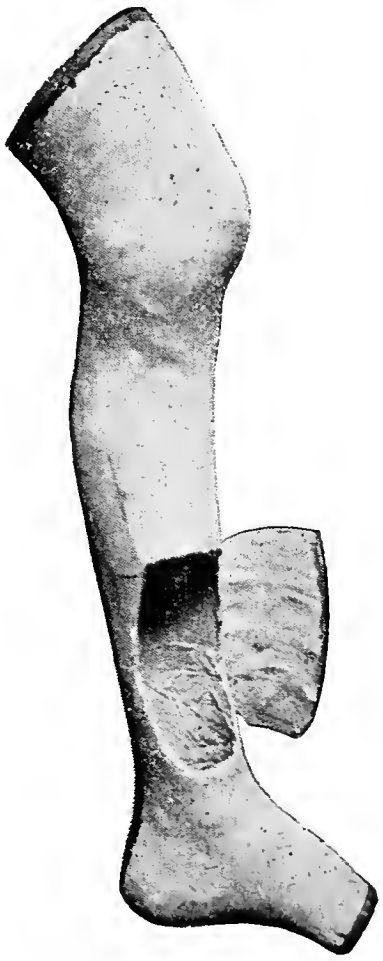
dry as possible between the fingers. It is then applied as an ordinary roller. If an extremity is to receive the dressing, an initial flannel roller should be applied; if the trunk, a neatly fitting cotton or woollen jacket. Having applied a sufficient number of bandages to give the required support, the dressing is covered with a layer of plaster spread on by the hands smoothly, and of thickness sufficient to completely hide the turns of gauze. When this layer has begun to *set*, a very bright shining surface and one which keeps clean may be given the dressing by rubbing it with a pad of cotton saturated with alcohol.

In the use of plaster of Paris the proper care of the hands should not be overlooked. A little vaseline applied in and around the nails does no harm to the dressing and facilitates the removal of the plaster from the finger-tips. Nothing, however, restores the skin, removing the unpleasant harshness which the plaster causes, so perfectly as sugar. It is used by simply dissolving it upon the fingers with plain water.

A window or trap-door in a plaster-of-Paris dressing is best made in the following manner: A half-inch band of lead tape, of a length equal

to the circumference required for the window, is formed into a loop or ring by closing the ends together with a bit of rubber plaster. This is applied to the limb, and, modelled into an ellipse, circle, or square, is held in position by the initial flannel bandage, which also retains the wound dressing. After the plaster of Paris has set, the outline of the lead wall, being distinctly apparent, is cut down upon with a penknife, except at one point which is to act as a hinge, and the lead band removed, as shown in Fig. 78. Beneath the everted flange-like edge of the window absorbent cotton should be inserted in order to prevent the entrance of discharge between the fixed dressing and the skin. The trap thus formed is afterwards kept in place by a bandage. Should the window exceed in width one-third the circumference of the limb,

FIG. 78.



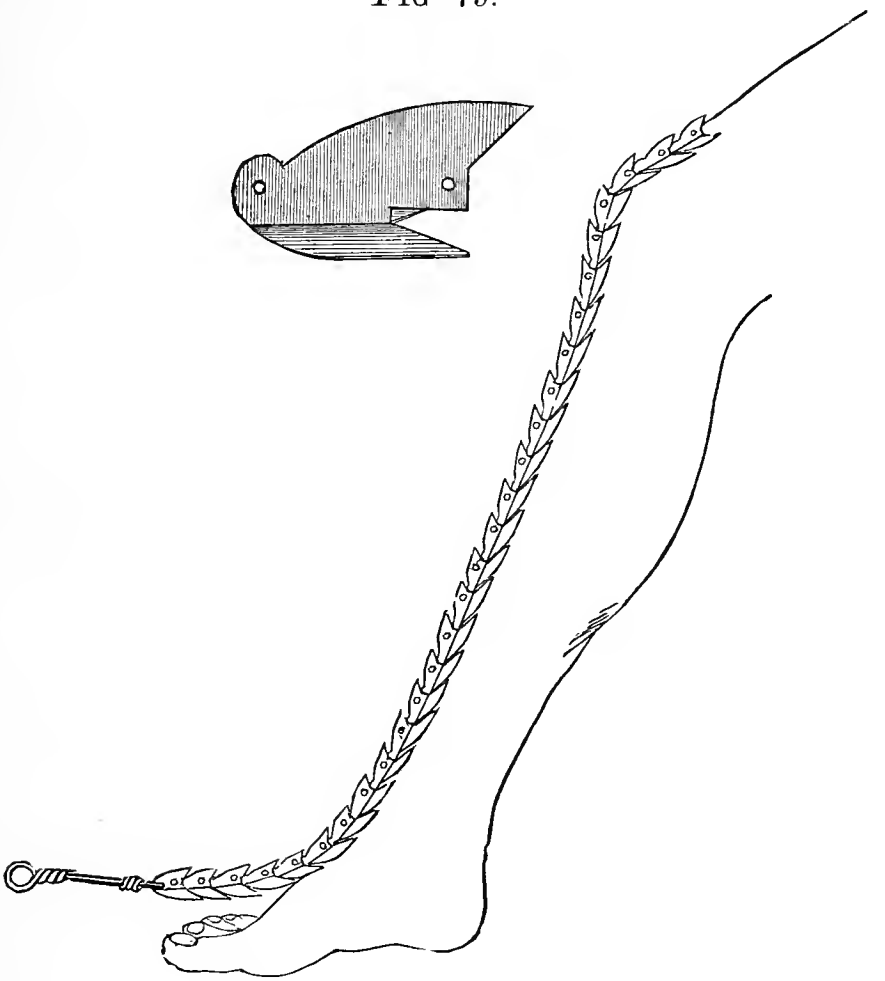
Trap-door.

the dressing may be reinforced by strips of tin layed at the back during the application of the plaster bandages. In this way extensive compound fractures of the leg may often be appropriately managed.

The Removal of Fixed Dressings.—The preliminary steps to facilitate the ready removal of fixed dressings are often taken when the dressing is being applied. A strip of lead tape placed upon the limb next to the skin protects the latter from the point of a penknife which may be used to make a long section in the dressing immediately the plaster has set. The lead tape is then withdrawn. A device which leaves in the dressing a hollow ridge best prepares it for easy removal. Such an apparatus is shown in Fig. 79. It consists of a vertebrated chain, constructed of brass, and so formed that when it is placed upon a part prior to the application of a fixed dressing, it will, on withdrawal, as soon as the dressing has set, leave behind it in the latter a hollow longitudinal ridge. This may be readily divided by a knife or plaster shears at any time it is desired to remove the dressing, and, a clean straight cut being thus made, the splint will be in a suitable

condition to reapply if necessary. As applied to the part, the chain presents on cross-section the form of an inverted T; and, although it

FIG 79.

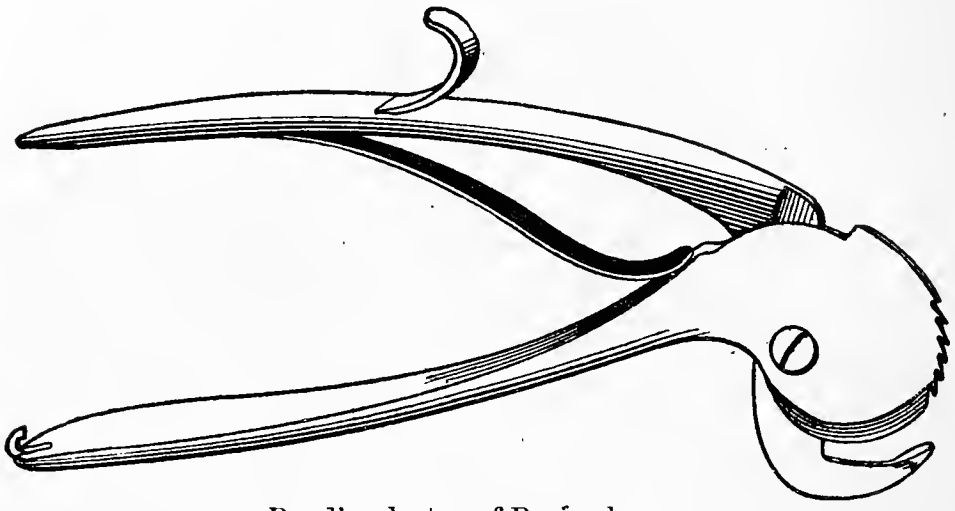


Vertebrated chain for fixed dressings.

increases the circumference of the limb a fraction of an inch, it does not affect the proper tension of the dressing. When a hinge in the dressing is required, two chains are applied, the

ridge formed by the one in front being cut, while that behind makes the joint. If the chain has to travel over a very sharp curve, it should be wrapped in wax-paper, in order to bridge over the spaces between the widely separated spines. A T-shaped rubber strip made by R. Levick's Son & Co. answers the same purpose, and in-

FIG. 80.



Reed's plaster-of-Paris shears.

deed is an improvement upon the brass chain. Whether such a hollow ridge has or has not been made in the dressing, by far the best device for removing it is Reed's plaster-of-Paris shears. With these a clean cut is easily and rapidly made. As shown in Fig. 80, a rotary movement is given to the upper blade, and it is prevented from slipping by the serations in its anterior edge.

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